RAILROAD GAZETTE

FRIDAY, NOV. 27.

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Contributions.

Safe Coupler Unlocking Gear.

TROY, N. Y., Nov. 21, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In a very interesting article in your issue of Nov. 13, you point out the diversity of unlocking devices in the vertical plane couplers at present in use, and express the opinion that some action will soon have to be taken by the Master Car Builders tending toward the adoption of a standard unlocking device.

While in the main agreeing with your remarks as to the increased safety to trainmen which would result from a fixed position of the handle of the unlocking device, there is one much more important point affecting their security to which you did not refer, and that is the necessity of adopting an unlocking device by which the knuckle can be opened from outside the tracks, so that the trainmen will not have to go between the cars either to couple or to open the knuckle for coupling. This point was brought out by railroad men at the meeting, recently held in New York, of the committee appointed at the last National Convention of Railroad Commissioners to formulate a bill to be presented to Congress on the subject of safety appliances.

In fact since the whole question has been raised and the vertical plane type adopted in order to diminish the great loss of life of brakemen, it would seem self evident to any reasonable man that if the choice were governed by humanitarian principles any coupler of that type which has all the other advantages of any of them and in addition is so constructed that a brakeman need not go in between the ends of the cars to open the knuckle, should be given the preference.

But another reason which should govern the managers of railroads in this state and at least three others, and cause them to choose a coupler with a knuckle-opening device is that the law distinctly states that their roads must be equipped with couplers which will obviate the necessity of brakemen going between the ends of the cars. Any one who has seen trainmen go in on an icy track before a moving section of a train, as they must do in their ordinary work, to open a knuckle, will appreciate the reason for this law, and when it is remembered that the penalty for the non-observance of its provisions, when the time for equipment has elapsed, will be the payment of damages to injured employés who will then have just cause for action, it is believed that those officials who from negligence or other causes have wasted the money of their corporations by providing couplers which are only automatic in locking, and the knuckles of which have to be opened by going between the ends of cars will not be held blameless on account of the pecuniary loss entailed without considering that their culpable lack of discrimination has added to the long list of cripples and to that of those whose lives have been sacrificed without necessity during the faithful performance of their duty.

A correspondent, in your issue of Nov. 20, assumes that the upper lock lifting device common to six of the couplers now on the market will be adopted as a standard in spite of the fact that the knuckles of all of these couplers must be opened by hand. Is it reasonable to suppose that any vertical plane couplers not having an opening device, which is second only in importance to their automatic closing, will be adopted as a standard merely because their hand-rods look somewhat alike, when the fact is well known that no two of them have rods at all interchangeable?

These remarks are made in consequence of a statement at the meeting of the committee above referred to, that there was no coupler with an opening device, while as a matter of fact the Trojan coupler fully answers this requirement. It is of the M.C.B. standard, and by its use all necessity of passing between the ends of the cars is avoided. Thousands of them are in use on fourteen different railroads and it has an unequaled record for strength, durability and ease of action. Its hand-rod, simpler in construction and cheaper than that of most of the others of the type, reaches to the end of the car with its handle in the position occupied by that of those most in use, as shown in the illustration on page 794 of your issue of Nov. 13.

THE TROJAN CAR COUPLER CO.

Emery Wheels.

29 BROADWAY, N. Y., Nov. 6, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in your issue of Oct. 9 last a report on emery wheel trials which, as stated in said report, was made at the suggestion of the Tanite Emery Wheel Co. Having a general knowledge of the practical and commercial standing of all the several grinding wheels upon the market, I was surprised at the conclusions arrived at, although, upon second thought, more at the methods adopted than at the results, which could not be otherwise under the circumstances of said trial.

The report presents a wholesale condemnation of all makes of emery wheels tested "save one!" in favor of the Tanite wheel. A peculiar feature of these tests, when the results are reported as written, is, that while the Tanite people had free access to the test and its jury, and a free privilege to furnish any number and quality of wheels (it is stated in the report that "*more* than three times as many of these [Tanite] wheels were used as of any other make"), no other makers were aware what was going on.

The report presents a new desideratum in emery wheel practice in its statement that: "It was unanimously agreed that hand testing must be done away with and the personal factor eliminated [was it?] in order that the results might be unimpeachable." Now every manufacturer and user of emery wheels will agree with me in the statement that—if this exceedingly uncertain feature of hand pressure or hand work could be eliminated in the regular, ordinary and practical uses of the wheels, the main and leading troubles of emery wheel construction and use would be done away with, and the Tanite wheels stand more acceptable in the market, and would not have needed a bolstering test to advance their interests. They, with all other makers, can furnish a good wheel for automatic work; the hired operator and user, however, cannot be controlled or induced to give or to have that delicacy of care that the Tanite experimenters were so particular to make use of, in their possible ignorance of the necessities of the case.

Even in the matter of automatic grinding it is, a fixed, unchangeable and unimpeachable axiom of the emery wheel trade that it must be known what kind of work is to be done before submitting a wheel for trial or for use. The Tanite Co. in their trade circular are careful to state concerning this matter that "to insure the satisfactory filling of an order, customers *must* state the general class and the *special* or *exact work* the wheel is to be used for." In what then can the reliability of a test of opposition wheels consist, which quietly and innocently calls for and purchases from ordinary stock three or four wheels of a certain diameter and a certain thickness, of various opposition manufacturers, without giving any information as to the work expected of them, and which bases its results upon the use of "more than three times as many of these [Tanite] wheels as of any other make?" Again, in their trade circular, the Tanite Co., after calling attention to some seven classes of wheels of regular make, which it is stated are each only good for certain purposes and objects, adds the well known fact that "some experienced mechanics desire still more carefully modified classes, and we have a variety of special classes not named in the above list" of seven classes. As well indeed might this Stevens Institute laboratory test have included a sample of two or three files and rasps and expected each to do the work of the other, or the two or three samples to do the work of all styles of files or rasps, as for a few selections of opposition emery wheels to compete with a wholesale set of samples of their one make of emery wheel.

Some of the wheel manufacturers make it a specialty to have on hand wheels of 50 or more different degrees of hardness varying between the extremely soft and the extremely hard, and likewise they have wheels of 25 and more different degrees of coarseness of grinding material, and from these even it is indeed quite a matter of experienced judgment and trial to select a wheel best suited to the work to be accomplished. A wheel cannot be *tested* into a good reputation; it must meet the demands and necessities of the trade, and must be acceptable to the user who orders it and who pays for it.

Please permit me to conclude with a quotation from an article written for the *American Machinist* by Mr. J. F. Holloway on "The Superiority of Independent Condensers for Marine Engines on the Lakes." It places the matter in a nutshell and meets the subject with the best possible force and in the best possible manner. Mr. Holloway in his article expresses a desire "only to remind the reader that while it may be possible to prove many things theoretically failures, yet the fact often remains that they are practically and commercially a success."

WILLIAM H. WEIGHTMAN

The Tanite Co.,
STROUDSBURG, Nov. 12, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In his letter to you of Nov. 6, Mr. W. H. Weightman criticizes the report by Coleman Sellers, J. E. Denton and Alfred R. Wolff, on the Comparative Value of Fifteen Varieties of Emery Wheels. This report was avowedly a preliminary one. The investigating board are now preparing that more detailed statement which was promised in the preliminary report. This fuller statement ought to prevent such premature criticisms as that of Mr. Weightman.

Owing to the misplacement of a parenthesis the report erroneously states that only one make of wheel was submitted to "hand testing." The fact is that all makes were so tested, and the comparative results of such tests were as much in favor of the Tanite as were those of machine tests. The element of unknown pressure applies to all hand tests, and weakness, fatigue, personal bias, etc., etc., might all interfere and make hand tests useless. It was to eliminate all the uncertainties dependent on the personal factor that a machine test was preferred.

The first mechanical impeachment of the results is that they relate only to an easy form of automatic work and therefore do not warrant conclusions as to general grinding. The defect of existing test machines alluded to in the report was that they were too purely automatic to warrant general deductions. A special machine was devised with the idea that it would allow of equal and measurable pressure and yet simulate hand grinding. The reports states that "after many preliminary trials with this machine its results were compared with those obtained by individual operators under various conditions." It says that "the results approximated closely to those obtained by hand pressure and yet were independent of all influence from the operators of the machine."

The only other mechanical impeachment is that the opposition manufacturers furnished tools without knowing what work they were intended for, and so supplied unsuitable wheels, while the successful firm were informed as to what would suit. The fact is that each maker received a request identically the same and which stated the character of the work. The character of the machine was not stated, and the successful firm knew as little about the suitability of its wheels to this newly devised machine as did the opposition manufacturers. Though the successful firm did supply more than three times as many wheels as of any other make, these wheels were of uniform quality and no change was made subsequent to the original selection.

The adaptability of the machine and the value of methods are legitimate subjects of enquiry and criticism, but the impartiality and fairness of the trial cannot be questioned without attacking the characters of men distinguished in the mechanical world. The condemnation passed and the praise given are, of themselves, proofs of impartiality. The defects announced by the report are too glaring to be explained away. If 57 per cent. of six makes of wheels burst under conditions which nine makes submitted to with comparative safety, then the six are less fitted for heavy use or misuse than the nine. Even if it should be shown that some of these burst under excessive pressure, the fact remains that excessive pressure often occurs owing to carelessness or miscalculation.

The acceptability of a wheel in the market, in these days, has little to do with the matter. The writer has often shown that the fewness of the wheels used in any one department of a factory and the conditions of use are such that the money value, as of a productive tool or machine, is rarely calculated. Among the fifteen makes are two which have sold freely for about 25 years. Under equal conditions, the average production of one of these is $\frac{42}{100}$ of 1 oz., per minute, and that of the other $5\frac{13}{100}$ of 1 oz. This great discrepancy would seem to indicate some great difference in quality, and probably value, yet both have been successful enough commercially to maintain business for a long period. Trash may be commercially successful. Even things radically defective may be made to work, if the defects are compensated for in some way. These facts do not make defects or trash desirable.

The investigation criticised by Mr. Weigh man was intended to supply exact data on a subject where such data were conspicuously lacking. While some of these data may possibly only apply to the actual wheels tried, and to their trial on a special machine, many of them are of general application.

It appears that six makes, practically and commercially successful, are dangerous to life and limb. A succession of fatalities has not stopped their success. These losses of life have been attributed to the carelessness of workmen or considered unexplainable. The investigation proves that under a variety of conditions a large average of certain wheels burst, while others were subjected to the same trials without injury; and it seems clear that the bursting in these cases was not due to carelessness, and was not unexplainable. It seems a fair general deduction that these wheels are likely to burst under certain conditions frequently met with. In fact the fatalities due to these wheels are not accidents at all.

These experiments prove that the average productive capacity of eleven makes was very small; this being true under a variety of conditions. It also proves that their

productive capacity steadily decreased. It seems a fair general deduction that under a variety of pressures these wheels will clog or glaze when used to grind cast iron, and will deteriorate in cutting power. Nevertheless, these wheels are so freely used as to be commercial successes, because the data thus scientifically demonstrated do not assume striking prominence in the practice of the grinding room.

If workmen knew that certain wheels were essentially dangerous they would soon refuse to use them. If the man who really pays for the wheel could read the columns of figures which demonstrate the low cutting of some of these wheels he would refuse to pay for any more of them, no matter how acceptable they might be to the purchasing agent, who bought them at a big discount, to the grinder who failed to recognize their defects and to the foreman or superintendent who found the problem of a wheel's productive capacity and its cost too complicated to bother over, considering the small number of wheels used.

As to the peculiar character of this trial it seems clear that 15 rivals could not have been induced to share the costs of such an inquiry, and many would have refused to compete even without cost. One concern was enterprising enough to risk both cost and result and is honest enough to the manufacturing public to state these results, even though by so doing it increases the trade of rivals whose wares it has proved good, and incurs the dislike of those competitors whose wheels it finds to be commercially successful trash.

T. DUNKIN PARET,
President of the Tanite Co.

Tests of Baldwin Ten-Wheeler on the Baltimore & Ohio Road.

I.

It has been generally understood that the Baltimore & Ohio Railroad was operating on the Piedmont grade some of the heaviest express locomotives in the world. It was stated in the *Railroad Gazette*, June 13, 1890, that these engines were developing over 1,300 H. P., according to the data which was then given out regarding their performance. To determine exactly the conditions of operation and the power developed, tests were made by Mr. D. L. Barnes for the *Railroad Gazette* during the month of May last, the main object being to determine the maximum horse power exerted by these engines on the Piedmont grade and the efficiency of the

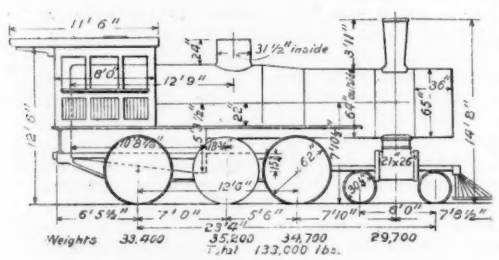


Fig. 1—Baldwin Ten-Wheeler—Baltimore & Ohio Tests.

engine when generating that power. During these tests there were several incidental investigations made regarding the operations of locomotives of this type in a general way. These consisted in the measurement of the wetness of the steam furnished by the boiler, the vacuum produced in the smokebox, the temperature of the smokebox, the slip of the drivers going up the grade with a heavy load, the accuracy of water meters, and a determination of some convenient method of measuring fuel used in such tests.

The general design of this ten-wheeler, by the Baldwin Locomotive Works and known as class "B" 7, No. 1,304, is shown by the accompanying outline cut, fig. 1. The following are the general dimensions:

Centre to centre of cylinders	86 in.
Out to out of frames	51 in.
Size of firebox	33⅞ × 120 in.
Length of tubes (in to in of tube sheets)	13 ft. 2¾ in.
Diameter of tubes (outside)	2¼ in.
Number of tubes	237.
Centres of tubes	3 in.
Grate area, sq. ft.	28.23.
Heating surface, tubes (outside) sq. ft.	1846.8.
Heating surface, firebox, sq. ft.	188.54.
Heating surface, total sq. ft.	2,035.39.
Total length (over pilot and tender draw head)	58 ft. 8¾ in.
Thickness of boiler sheets (barrel)	9/16 in.
Travel of valve	5½ in.
Tractive force per pound of E. P. per sq. in.	184.9.
Date when built (first number)	Apr., 1890.
Diameter of double exhaust nozzle	3¼ in.
Total weight of locomotive in working order	133,900 lbs.
Weight on drivers	103,300 lbs.
Weight on truck	29,700 lbs.
Diameter of driving wheel	62 in.
Weight of tender empty	35,100 lbs.
Other dimensions as shown by fig. 1.	

The Piedmont grade commences at the Piedmont station and is about 16.8 miles long, to Altamont at the top of the grade. The percentage of grade is nearly uniform, as shown by the diagram fig. 2. It approximates to 2.2 per cent. These engines haul the regular through express trains from Keyser, which is five miles east of Piedmont, to Grafton, the total length of the run being 78.7 miles. The approximate grades are given on the diagram. The schedule time tables is as follows:

Intermediate distance.	STATIONS.	Total distance.	Going West. P. M.
	Keyser.....Lv.		4 30
5.0	Piedmont	3.0	4.40
1.2	W. V. C. Junc	6.2	*4.43
6.6	Frankville	12.8	*5.01
5.1	Swanton	17.9	*5.15
3.9	Altamont	21.8	*5.26
2.7	Deer Park	24.5	*5.31
3 4	Mountain Lake Park	27.9	*5 .7
2.6	Oakland	30 5	5.42
3.0	Skipnish Junction	33.5	5.45
2.6	Hutton	36.1	*5.51
4.5	Terra Alta	40.6	*5.56
5.2	Rodemer	45.8	*6.04
7.1	Rowlesburg	52.9	*6 14
6.3	Tunnelton	59 2	*6.29
1.1	West End	60.3	6.48
1.9	Austen	62.2	*6.50
3.7	Newburg	65.9	*6.54
1.2	Independence	67.1	*7.01
6.1	Thornton	73.2	*7.03
5.5	Grafton.....Ar.	78.7	*7.14
			7.25

The tests on the long run from Keyser to Grafton, 78.7 miles, showed that the meter measurements of the water used were far more accurate than any measurement that could possibly be made by the tank glasses. In two long runs such as the above the difference between the glass readings and the meter readings was found to be less than 0.7 of one per cent., and it was decided that the errors incident to reading water glasses on tanks were greater than the error of the meters, and therefore the meter readings were used in all cases.

Pyrometer.—This instrument was made in Germany, and is a particularly good one, as the expansion portion is about 3½ ft. long, and it proved to be much superior to an American pyrometer with a short barrel, which was tried in the first experiment. It was calibrated after the tests were finished and found to be practically correct at the ordinary temperature, at the boiling point of water, and the melting point of lead. The degrees given are on the Fahrenheit scale.

Indicators.—A Thomson indicator was used with 80-pound spring. The springs were found to be practically

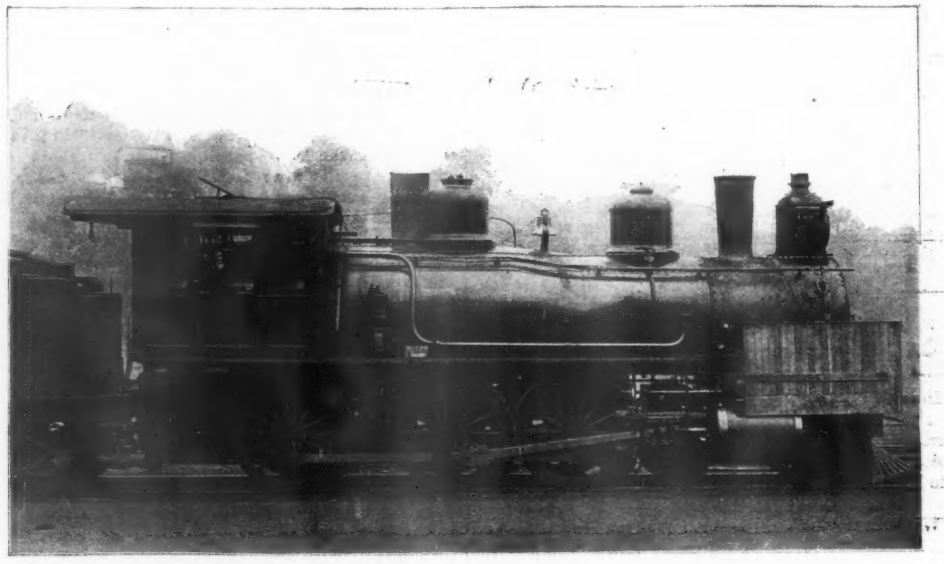


FIG. 3—BALDWIN TEN-WHEELER—BALTIMORE & OHIO TESTS.

Intermediate distance.	STATIONS.	Total distance.	Going East. A M.
5.0	Keyser.....Ar.	78.7	8.39½
1.2	Piedmont	73.7	8.30
6.6	W. V. C. Junction	72 5	*8.28
5.1	Frankville	65.9	*8.14
3.9	Swanton	60.8	*8 03
2.7	Altamont	56.9	7.50½
3.4	Deer Park	54 2	*7.47
2.6	Mountain Lake Park	50.8	*7.40
3.0	Oakland	48.2	7.32
2.6	Skipnish Junc	45.2	*7 26
4.5	Hutton	42.6	*7.20
5 2	Terra Alta	38.1	7.13
7 1	Rodemer	32.9	*6.56¾
...	...	...	*6.34½
6.3	Rowlesburg	25.8	*6.33
1.1	Tunnelton	19.5	*6.22¼
1.9	West End	18.4	*6.17
3.7	Austen	16 5	*6.13
1.2	Newburg	1'.8	*6.01½
6 1	Independence	11.6	*6.01
5.5	Thornton	5.5	*5.50
...	Grafton.....Lv	....	5.42

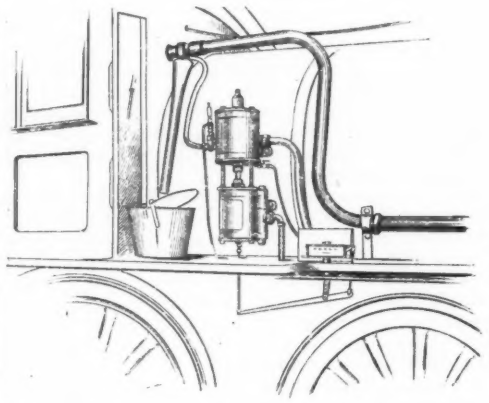


Fig. 4—Measurement of Injector Overflow—Baltimore & Ohio Tests.

DESCRIPTION OF APPARATUS.

Water Meters.—The water used was measured by water meters furnished by the Thomson Meter Co., of Temple Court, New York City. They were suitable for the 2-in. feed pipe, and had an ultimate capacity of 15 cu. ft. per minute. These meters were calibrated by the

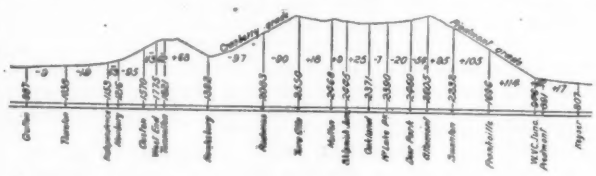


Fig. 2—Profile of Track, Keyser to Grafton—Baltimore & Ohio Railroad.

builders before being shipped and were afterward calibrated during the test. The meters were put in the feed pipes of the injectors and check valves were inserted between the injectors and the meters to prevent hot water from injuring the diaphragms; the meters will not stand hot water. The accompanying cut from a photograph shows the location of the meters and the method of attaching them. See fig. 3. The dials read to a small fraction of one cubic foot.

To test the accuracy of the meters in actual service, on several occasions water was fed from the tank which was provided with water glasses through the meters into the boiler in the same manner as if the engine was in operation. Accurate readings of the meters and equally accurate measurements of the tank glasses show that the meter accounted for all water fed into the boiler.

free from errors. The indicator was mounted over the centre of the steam chest with pipes as short as possible leading into the cylinder head. The pipes were well covered. A connection was also made to the top of the air valve to record the steam chest pressures. The indi-

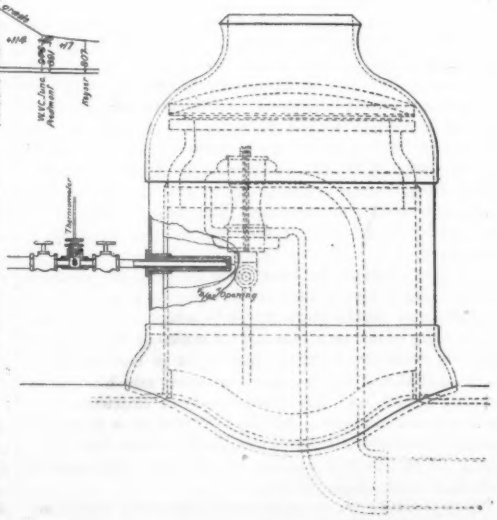


Fig. 5—Second Calorimeter—Baltimore & Ohio Tests.

cator drums were driven by a short cord connected with a wire attached to a plain pendulum lever driven by the crossheads, as shown by the accompanying photograph, fig. 3.

Speed Recorder.—A Boyer speed recorder was mounted on the front bumper and driven by a wire spring belt from a pulley placed on the truck axle. The usual connection was made with a dial placed in the cab and record of the speed was taken by a man in the cab as well as automatically recorded by the machine itself. The work of this device was most satisfactory, and sufficiently accurate for all purposes of this test.

Revolution Counter for Drivers.—A revolution counter for the drivers was mounted in the indicator box, and the readings were taken at the mile post where possible, in order to determine the amount of slip of the drivers and the accuracy of the speed recorder. This device was driven by a rod directly from the indicator pendulum.

Overflow of Injectors.—A large pail (see fig. 4), graduated on the interior, was placed on the running board, and a short connection was made between it and the injector overflow. After a considerable number of tests while running it was found that but little water was lost in this way. However, all losses have been accounted for in the data which follows.

Water Line in the Boiler.—The water line in boiler was determined as nearly as possible by reading the water glass and trial of the gauge cocks. This was necessarily only an approximation, but on account of the large amount of water used the percentage of error is small. At starting the water line was carefully observed, and at the end of the trip the boiler was filled to the same level as at starting before the final water meter reading was taken.

Fire Line Measurement.—The surface of the fire was carefully observed by three persons before starting, and at the end of the trip the same persons agreed as to the amount of coal required to bring the fire to the same level as at starting. After the fire at the end of the trip was filled to the agreed level, the same persons again estimated its proximity to the original level. After this the coal remaining in the tank was taken.

Coal Measurement.—The coal used during the trip was taken from bags which held 125 pounds each. These bags were carefully filled and weighed before the beginning of the trip, and the number of bags used could, therefore, be readily determined without weighing the tender. This removed, the errors in fuel measurement which would result from weighing the tender each time. When an unusually large amount of coal was needed, a lot of loose coal was dumped on the tender in front of the bags and was used before any was taken from the bags. In this way the test was finished by using coal from the bags, and therefore it was not necessary to weigh the tender.

Reverse Lever Position.—The position of the reverse lever was determined by marks on the jacket of the boiler in the cab. A pointer in the lever extended to the marks on the jacket. The following cutoffs correspond to the different notches:

Cut-offs Corresponding to Notches in Reverse Lever Quadrant.

Notch number.	Cut-off.	Notch number.	Cut-off.
1	21⅛	6½	14¼
2	21⅞	7	11⅜
3	19⅞	7½	....
4	18⅝	8	9
5	16⅛	9	6¼
6	14¾	10	3⅜

Vacuum Gauge.—This gauge was formed by bending the upper end of one of two vertical glasses and attaching thereto a rubber pipe ⅝ of an inch inside diameter, which extended from the gauge to the smokebox, where it was attached to a ¾-in. pipe, which entered the arch about 3 in. from the inside of the sheet and at the centre of its length. This gauge was located near the dome, where it could be read by the man who had charge of the calorimeters. The glass tubes were mounted on a graduated board.

In early experiments this gauge was located over the fire door on the back of the cab, but it was later found more convenient to have it placed where the man in charge of the calorimeters could make the records. As far as could be seen there was no particular difference between the readings when it was located at the dome and when it was placed on the back of the cab. There was possibly a little less vibration with the longer connections.

Calorimeters.—Two forms of calorimeters were used in this test—one the Barrus, and the other a simple device made at the Piedmont shop to record the rapid changes in wetness which are peculiar to locomotive operation. From the Barrus calorimeter a pipe led into the dome near the throttle in such a position as to intercept the current of steam to the throttle. The end of this pipe was provided with holes about $\frac{3}{16}$ of an inch in diameter. The instrument was mounted in its complete form according to the directions given by Mr. Barrus, except that it was put into the steam dome instead of the steam pipe. The dome location was selected as being the best point to show the exact nature of the steam fed to the cylinders, and to show at the same time the character of the boiler as a steam producer. Mercury was used in the thermometer cups at first, but afterward cylinder oil was substituted, as the mercury bubbled because of moisture entering the cups. The end of the pipe in the dome was provided with an elbow instead of perforations, in order that there might be no question of the water in the steam having a chance to reach the calorimeter. It was thought that an elbow turned down in the steam dome under the throttle and in the current of steam passing to it, would be more liable to collect a fair sample of the steam than a perforated pipe; but, for reasons which will appear later, it was deemed better in the second test to use a perforated pipe, in accordance with the directions accompanying the instrument, in order that there might be no question as to its action.

The thermometers used in the calorimeters were calibrated and found to be so nearly accurate as to render unnecessary any correction of the records taken.

The Barrus instrument from the start showed almost perfectly dry steam. This seemed suspicious, as it is generally supposed that locomotive boilers prime badly at times, and to test the instrument the boiler was made to prime by filling it nearly full. In this condition the water was seen coming from the smokestack for a short interval at starting, yet the priming was not shown by the Barrus calorimeter, and for a time this offered a perplexing problem. The reason was later learned to be that the instrument was not sensitive enough to indicate priming during the extremely short time in which priming took place, owing to the heat retained by the thermometer cups and the fluids therein. It was also thought that the flow through the pipe in the dome with this calorimeter was not sufficiently rapid to conduct whatever water there might be in the steam and which would pass into the throttle because of the greater velocity through the throttle. It was believed that a mass of water might travel through the throttle because of the greater velocity of the steam at that point and yet not pass into a ¾-in. pipe placed horizontally in the dome, owing to the slower movement of the steam in that pipe. Hence the following described instrument was devised:

Second Calorimeter.—This instrument (see fig. 5) consisted of two pieces of brass pipe, one inside of the other, leaving an air space between the outer and the inner. The outer pipe was screwed into the dome and extended within the dome to the throttle. At this interior end the two pipes were joined together by a cap which had a perforation $\frac{3}{32}$ of an inch in diameter. On the outer end of the inner pipe was placed a globe valve, and next to this and outside of it a tee in which was a stuffing box and a thermometer, as shown by the sketch herewith. Beyond this tee was another globe valve and a short pipe of large diameter to carry the steam jet away from the man in charge.

With this device the point of most rapid movement of the steam was located next to the throttle and any water coming near it would immediately pass through the opening because of the high velocity. The thermometer bulb was bared to the steam and no cups were used. It was found possible to shut off the outer globe valve and expose the thermometer to a full boiler pressure without blowing the thermometer from the stuffing box. In this way it was determined that the thermometer recorded a steam pressure which corresponded to the steam gauge in the cab.

With this instrument priming was shown whenever the boiler was filled to a point where water could be seen coming from the stack, and in the case of a Northern Pacific engine, which was new and just put into trial service on this road, there was, because of oil on the sheets and other reasons, considerable foaming. Immediately when the boiler foamed the thermometer in the second calorimeter dropped to 212 degrees, while the second thermometer in the Barrus calorimeter did not drop for nearly a minute after foaming took place, thus showing inertia. It is believed that the second calorimeter is more accurate for locomotive work, because it often happens that the locomotive primes only at starting and not for a sufficient length of time to enable the Barrus instrument to make a true record. And again there are in a locomotive rapid changes in the rate of steam use which must cause rapid changes in the wetness of the steam.

Signal Apparatus.—To establish a communication between the assistants taking part in these tests, the following plan was adopted: Four electric bells were placed on the engine; two in the cab back of the engineer, one over the steam chest where the indicator cards were taken, and the fourth near the calorimeter and vacuum gauge. Buttons were placed so that any of these bells could be rung from the cab, and the assistant at the calorimeter and the front end could ring the bell in the cab. In this way signals were given to take calorimeter and vacuum gauge readings, as well as pyrometer, revolution counter and indicator readings, whenever there was a change in the conditions of operation of the engine. There was also a speaking tube between the man at the indicator and the cab through which verbal orders could be given when necessary. A fourth assistant recorded the fireman's steam gauge, the water line in the boiler, watched the firing, and assisted in reading the water meters and revolution counters, thus providing a check on all measurements.

TO BE CONTINUED.

The Twenty-fourth Meeting of the American Society of Mechanical Engineers.

THURSDAY MORNING, NOV. 19.*

Mr. W. E. Crane's paper on "Idiosyncracies of Chimney Draught," was read, and brought out quite an animated discussion, Mr. Kent claiming that in several instances cited in the paper the figures given agreed exactly with the theoretical results, and that as practice here proved the formulas, therefore the cases noted were not to be classed as "idiosyncracies."

A communication from Prof. Denton was read, taking a somewhat similar ground and figures were tabulated, showing comparisons between the observed and calculated amounts of draught for the varying heights and sizes of chimneys.

One member made a general statement to the effect that theory and practice did not agree regarding chimney draught, and gave a case in which he had been personally interested, where he wished to add more boilers to a stack already built, but which he found to be then doing its full calculated work (some 300 odd horse power). He determined, from necessity, to try an experiment and so connected boilers having several hundred more horse power (over double) to the stack, and found that he still obtained ample draught, practically the same as before. Considerable was said on the shape of chimneys both inside and out, and the respective advantages of the circular and square forms. The consensus of opinion seemed to be that owing to considerable error in the subject matter of this paper it should not be made a part of the printed transactions of the Society.

Topical query No. 105, "Is it better or not to have the lead increase with the load in high speed automatic engines, and if so, why?" was then taken up, and papers by E. J. Armstrong and W. O. Weber were read. These will be printed in a future issue. William Kent's paper on the "Influence of the Steam Jackets of the Pawtucket Pumping Engine" was then read. Discussion followed by Messrs. Jacobus and See, emphasizing the fact that if jackets were not a material benefit, then it would be possible to relieve our engines of an expensive and unnecessary adjunct.

On topical query No. 104, as to experience with systems for the purification of bad feed waters before they enter the boiler, either by precipitation or otherwise, Mr. Wheeler thought that comparatively little was known regarding surface condensers for purifying feed water and it was suggested that if there is any reliable data on the extraction of greasy or oily substances from water where high pressures were used in the boilers, such information be collected for a subsequent meeting.

Mr. Ashworth said that he had been using with success the Hoppes filters. He believed the water should be brought to the temperature of the boiler in order to precipitate the impurities properly. With the Hoppes system, carbonates, silicates, etc., are deposited on the under side of a series of shelves suspended one above the other through the centre of a cylindrical drum, the water flowing over the sides of these concave shelves and running in a thin film along the bottom to the middle where it drops to the next below.

Mr. Cogswell cited a case in which the successful purification of water at Syracuse had been accomplished by raising the water to the temperature of the boiler. This water being of such an admittedly bad quality, the treatment here was of especial concern. The discussion was of considerable interest, bringing out several points on which further information may be looked for at a subsequent meeting.

J. W. Coles' paper on "A Combination Iron and Oak Pavement" was then read. De Volson Wood's paper on "Test of a Pulsometer" was discussed by Mr. Emery, who will present a written discussion at a later date. In the discussion of query No. 93, on "The Arrangement of Chimney Stacks for a Battery of Boilers," Mr. Porter suggested that a battery of eight boilers should be arranged in pairs of two on each of the four sides of the chimney in something like a radial fashion, thus allowing equal draught for each of the series. This plan could be modified for batteries of 2, 4, 12 or more. Objections were immediately raised to any such scheme because the man in charge would find it more difficult to properly attend the battery on account of the distances to be traversed. The necessary building for such a plant would be expensive and wasteful, and the system would be limited in its capacity and inadequate for a plant of 75 or 100 boilers. The essential thing is to have each boiler get the same draught as the others. The proper designing of flues leading to the stack is the main factor and if this detail receives attention no trouble will arise from part of the boilers being farther removed than others. The expediency of using separate chimneys for each pair is largely a matter of local conditions and expense.

In the discussion on topical query No. 100—"Why should not the U. S. standard of 13 threads to the inch be used for ½-in. bolts instead of 12 threads." Mr. Porter stated that Whitworth's superintendent admitted to him the error in using 12 threads, as it reduced too greatly the diameter at the base of the thread, thus weakening the bolt unnecessarily. The adoption of 12 was the fault of the gradation in the Whitworth system, the threads decreasing by eighths from 1 in. down to ½ in., and as they com-

* The proceedings of Monday, Tuesday and Wednesday were reported in our last issue.

menced with eight threads, the increase one at a time brings 12 for ⅛ in. There is then a jump to 14, whereas the U. S. standard uses 12 for a ⅞-in. bolt (a size not in the Whitworth system), which brings 13 for ⅛ in. and 14 for ⅞ in. It was strongly urged that, as many of our manufacturers had from time to time adopted 13, the rest should make the change immediately.

In connection with Mr. H. C. Spaulding's paper on "Electrical Power Distribution," Mr. O. Smith referred to the peculiar advantages of the use of motors for tool work in shops, permitting as it did the connecting up of machines, singly or in pairs, and the fact that the use of carbon brushes reduced the necessary attention to a minimum. Stopping, starting and reversing quickly are points only possible with the use of electricity. An instance cited was that of a bolt cutter operated by a small motor when the machine made 10 reversals per minute for 10 hours per day, and had been in constant use for two years and eight months, and the brushes (carbon) were still in good condition. Similar cases were not wanting to prove its adaptability to many uses. The discussions then closed, and the society adjourned to convene again at San Francisco in the spring of 1892.

During the afternoon a number of places of engineering interest were visited by the members in groups, and in the evening a reception was given by the resident members at the Lenox Lyceum, Madison avenue and Fifty-ninth street, which proved to be a very enjoyable affair, and was attended by nearly all of the members present at this meeting.

Friday morning the Council met for the transaction of matters of business for the ensuing year.

Austrian Tests of Mild Steel for Bridge Building.

In the year 1887 the Royal Austrian Board of Trade invited the Austrian Engineers' and Architects' Society to decide upon the relative merits, as bridge materials, of wrought iron and steel. In compliance with this request, a committee was appointed, and in due course of time reported that in the light of the experience available at that time it was found expedient to recommend the use of wrought iron for the bridge in question. Subsequently another committee was appointed to take the matter in hand, and after an elaborate investigation submitted a long report last May. This report has just made its appearance in the *Zeitschrift* of the society, and from it we take the appended particulars and illustrations. The report is a comprehensive and intelligent contribution to the literature of the subject. The committee comprised 12 members, five of whom were engineers engaged in actual practice; two were professors at the technical high school at Vienna; two others were representatives of bridge building establishments, and three were metallurgical engineers.

The outcome of the early deliberations of the committee was a series of 216 tests of wrought iron, soft Thomas steel, and soft basic Martin steel. Without going into these tests in detail, it may be stated that of these materials the last mentioned proved superior to the other two in all important respects. The tests, however, had been made with the usual comparatively small test pieces, and were not considered sufficiently conclusive. In order to warrant a final opinion as to the merits of the materials, it was deemed desirable to institute a series of tests of full size riveted trusses or girders, and, to this end, the firm Ig. Gridl, of Vienna, offered to build the necessary large testing apparatus to construct the girders to be tested, and to afford all other necessary facilities to carry out the tests themselves. The Eisen-Industrie Gesellschaft, of Prague; the Austrian Alpine Montan Gesellschaft, and the Witkowitz Eisen Gewerkschaft kindly furnished the necessary materials for constructing the test girders.

These consisted of trussed girders of 10 metres (32.8 ft.) span and 1.2 metres (3.94 ft.) depth, with vertical posts and diagonals. Two such girders of the same material were in each case connected, parallel to each other, by cross bracing of 2⅜ × 2⅜ × ⅝ in. angles, and were tested to destruction by concentrated loading at the centre, the deflections and distortions under different degrees of loading being carefully noted as the tests progressed.

In February, 1889, five sets of comparative tests were made with girders of soft Thomas and Martin steels and wrought irons. In these the Thomas steel girders gave unfavorable results, while the Martin steel girders behaved in a highly satisfactory manner. The wrought iron girders did not fully come up to the expectations which had been entertained in regard to them, though the tests demonstrated the reliable and serviceable character of the iron.

In order to still further extend the range of its observations, the committee carried out a number of additional tests, among them two comparative tests with trussed girders of mild Martin steel in which the material had been worked up differently with respect to riveting, etc.; one test with a Bohemian wrought iron trussed girder; one test with a mild Martin steel plate girder; and one test with an old wrought iron plate girder from a railroad bridge, as a means of judging the safety of such old structures. These five tests were made in September and October, 1889, and, like the earlier trials, gave results very much in favor of the mild Martin steel as a bridge material. They demonstrated, also, the marked influence, on the resisting powers of a girder as a whole, of careful workmanship.

After the completion of these several tests sample pieces were cut from different parts of the broken girders for chemical analyses, and also for determining the elasticity, tensile strength and ductility of the materials used.

The trussed girders, as previously stated, had spans of 10 metres, and depths of 1.2 metres. Each girder was made up of eight panels, measuring 1.25 metres each. The bracing consisted of crossed diagonals and vertical posts. The chords were of T-section, made up of two angles 2¾ in. × 2¾ in. × ⅝ in. and a web plate 10 in. × ⅝ in., except in the two end panels, in which the web plate was omitted. The diagonal ties consisted of flat iron 4⅜ in. × ⅝ in., and the braces of two angle irons each 2⅜ in. × 2⅜ in. × ⅜ in., each forming a T-section. The vertical posts also were made up of two angle irons, each 2⅜ in. × 2⅜ in. × ⅜ in., with the exception of the end and middle posts which consisted of four angle irons. Every two such girders were connected parallel to each other by suitable cross bracing, as already stated, 1.25 metres (4.1 ft.) apart, and were tested as a whole. The general dimensions, adopted for the different members were the same as those which would have been used for a light railroad bridge.

The plate girders tested had a span of 10 metres, and a depth of 800 mm. (about 32 inches), the web plate being 10 mm. (0.4 in) thick. These girders also were tested in pairs, like the trussed girders, being properly braced horizontally.

The old plate girders were taken from a bridge which had been built in 1870, and had been in service for only one year, after which it was stored away. The girders were originally 14.1 metres long, but, for the purpose of the test, had been reduced to 10.3 metres. The web measured 500 by 4 mm. (about 20 × 0.16 in.)

The machine in which the several girders were tested is shown in figs. 1 to 5, and was designed by Mr. S. Wagner, chief engineer of the bridge works of Ig. Gridl. A skeleton diagram of the whole arrangement is shown in fig. 3, with details in figs. 2, 4 and 5. By placing weights on the end *C* of the long arm of the lever *C D* an abutment reaction was produced at the end *A* of the test girder *A B*, while the loading of the girder at the middle, equivalent to twice the reaction pressure at *A*, was attained by means of a hydraulic press plunger (fig. 2). The press and its pipe connections had been tested to withstand a pressure of 200 atmospheres. The press cylinder was carried by a pair of girders *E F G*, which rested on a solid masonry foundation, and to which anchoring rods were firmly attached

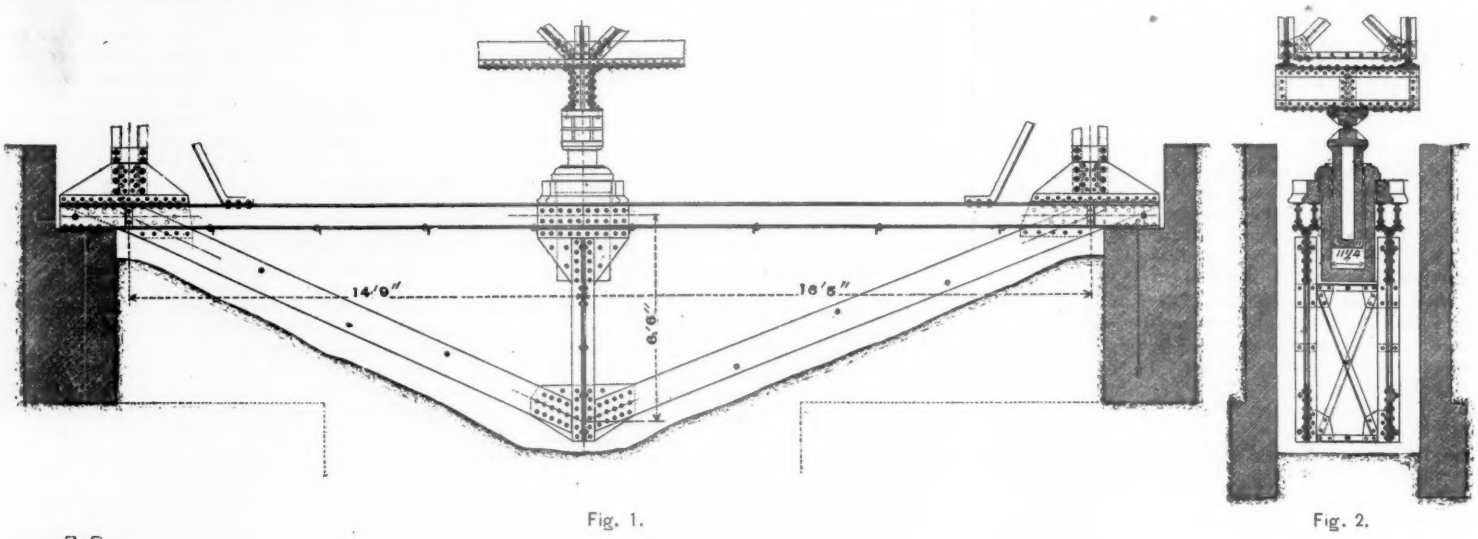


Fig. 1.

Fig. 2.

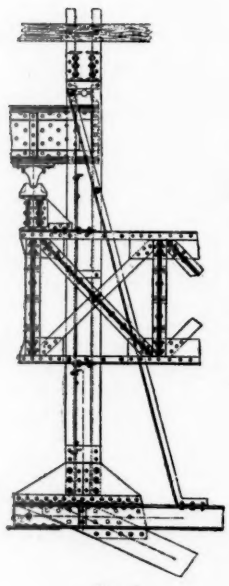


Fig. 5.

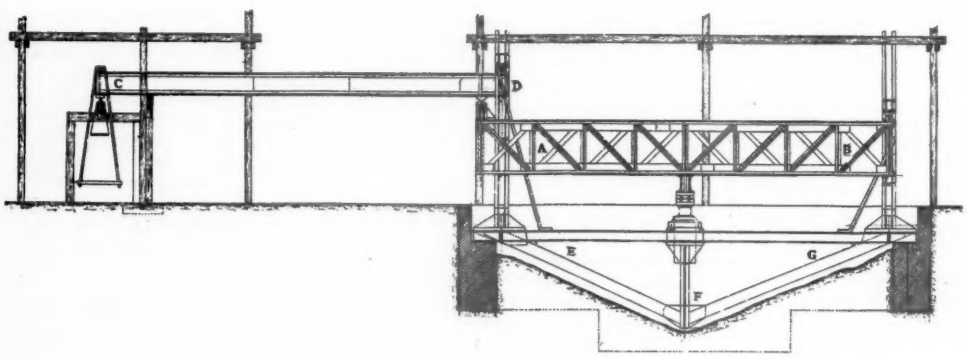


Fig. 3.

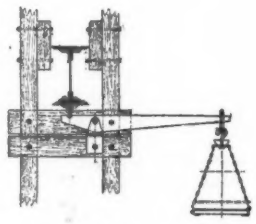
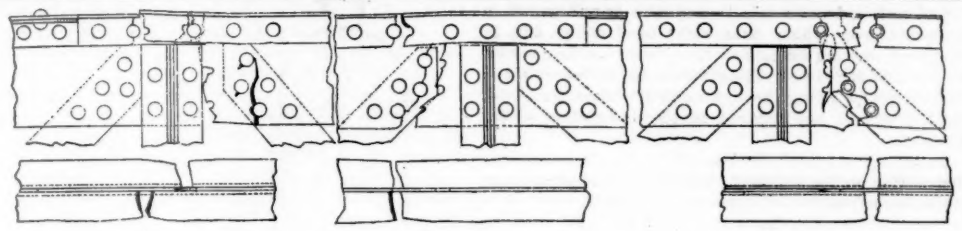


Fig. 4.

APPARATUS FOR TESTING FULL-SIZE BRIDGE GIRDERS.



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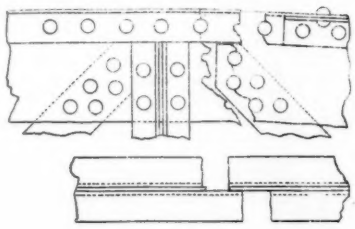

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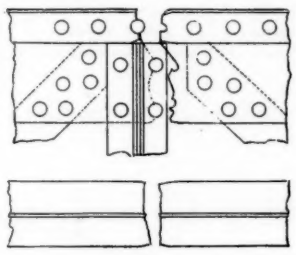

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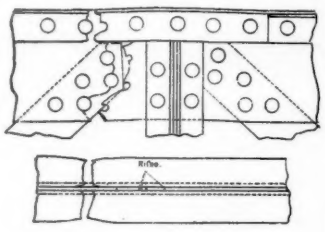

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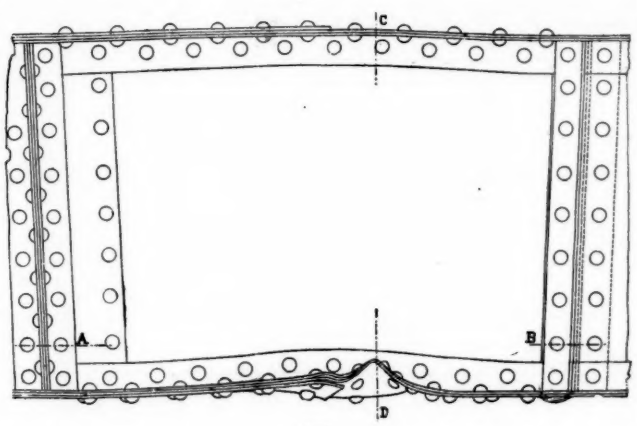

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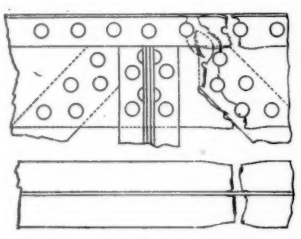

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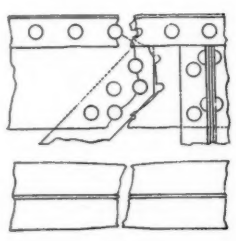

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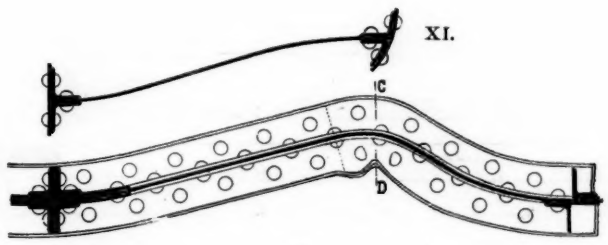


XI.

X.

TESTS OF FULL-SIZE GIRDERS.

which held down the right hand end *B* of the test girder, and the end *D* of the short arm of the lever *C D*. There was, in addition, a substantial wooden frame work which served as a guide for the girder under test.

When the load at the end *C* of the long lever arm balanced the load applied from below by the hydraulic press, the lever *C D* assumed a horizontal position, and the end *C* closed an electric circuit, causing an alarm to ring as long as the tension was maintained. The pump attached to the hydraulic press was, moreover, provided with a standardized Schäfer [& Budenberg manometer giving the pressure in atmospheres. In applying the loads, care was taken to avoid shocks. After each load application, the vertical and lateral deflections of the girders were measured by verniers at each vertical post. The lateral deflections were determined by having on each vertical post projecting points, whose distances from a taut steel wire, stretched longitudinally in the direction of the girder lengths, were measured.

In carrying out the tests the first load applied in each case was such that the strain produced in the chords under tension in the panel sections immediately adjoining the middle posts was 400 kg. per sq. centimetre (about 5,500 lbs. per sq. in.). Each succeeding test load was calculated to produce a further increase of 200 kg. per sq. centimetre (2,750 lbs. per sq. inch). Each test load was allowed to remain a few minutes, after which the girders were either entirely relieved from strain and allowed to remain thus for a short time, or the next load increment was applied. As soon as there was any sign of a set in the deflection the load was entirely taken off before applying a further increase and the permanent deflection was carefully measured. Under the higher test loads careful note was made also of deflection of rivets, etc. Diagrams I. to XI. show the manner in which the girders gave way and the points of failure. I. is a portion of a Thomas steel girder; II. shows a portion of a Martin steel girder; III., a section of the old wrought iron girder. The other diagrams show portions of girders of mild Martin steel of different makes; but VIII. illustrates the behavior of a new wrought iron girder. IX. represents a side view of a portion of a Martin steel plate girder; X. shows a plan and section along *A*, *B* and XI. represents a cross section along *C D*.

From the results obtained, the committee concluded that while soft Thomas steel is an excellent material in its way, it is scarcely what should be recommended for bridge construction, lacking, as it does, that homogeneousness which is of such vital importance in a structural material. This was apparent from the unsatisfactory behavior of the Thomas steel girders tested.

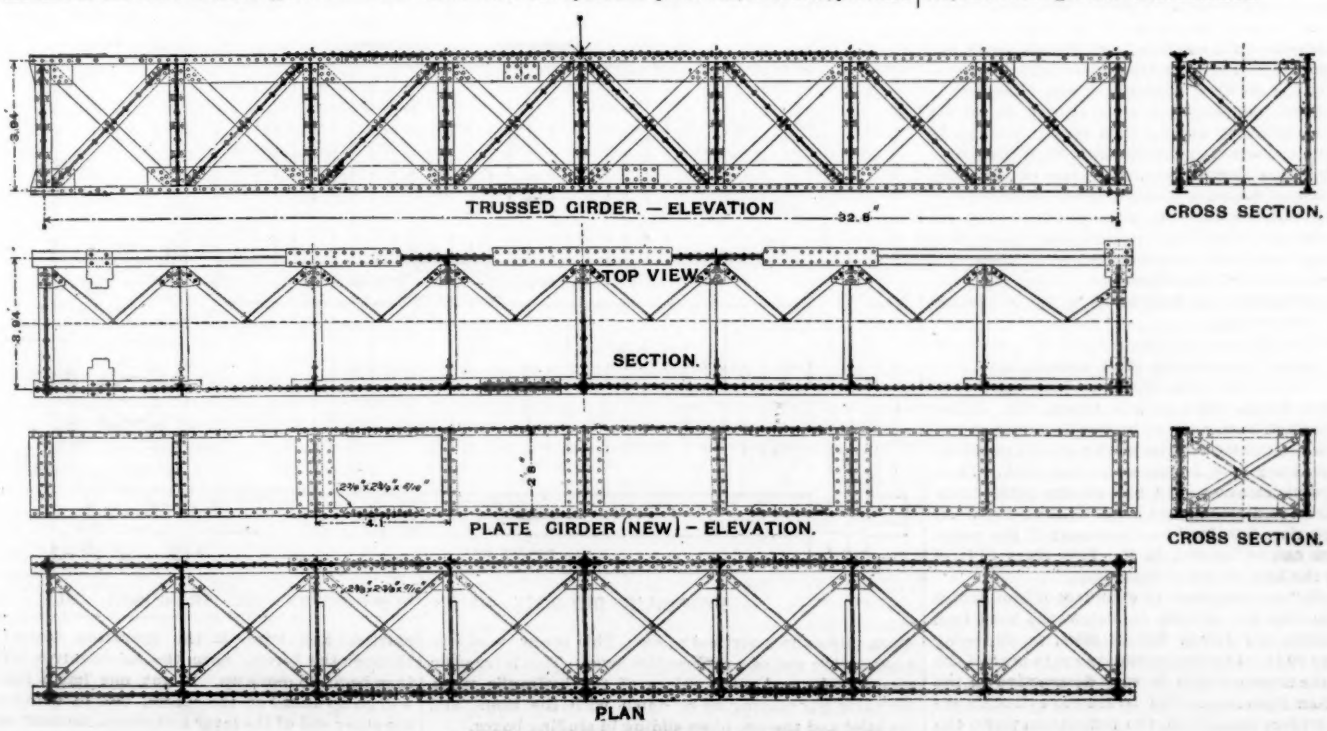
The wrought iron girders, generally considered, gave good results, but would not bear comparison favorably with the soft basic Martin steel girders, for which the test figures were uniformly excellent. Chemical analyses of this steel showed it to contain, on an average:

	Per cent.
Carbon	0.101
Manganese	0.340
Phosphorus	0.048
Sulphur	0.035
Silicum	0.024
Copper	0.080

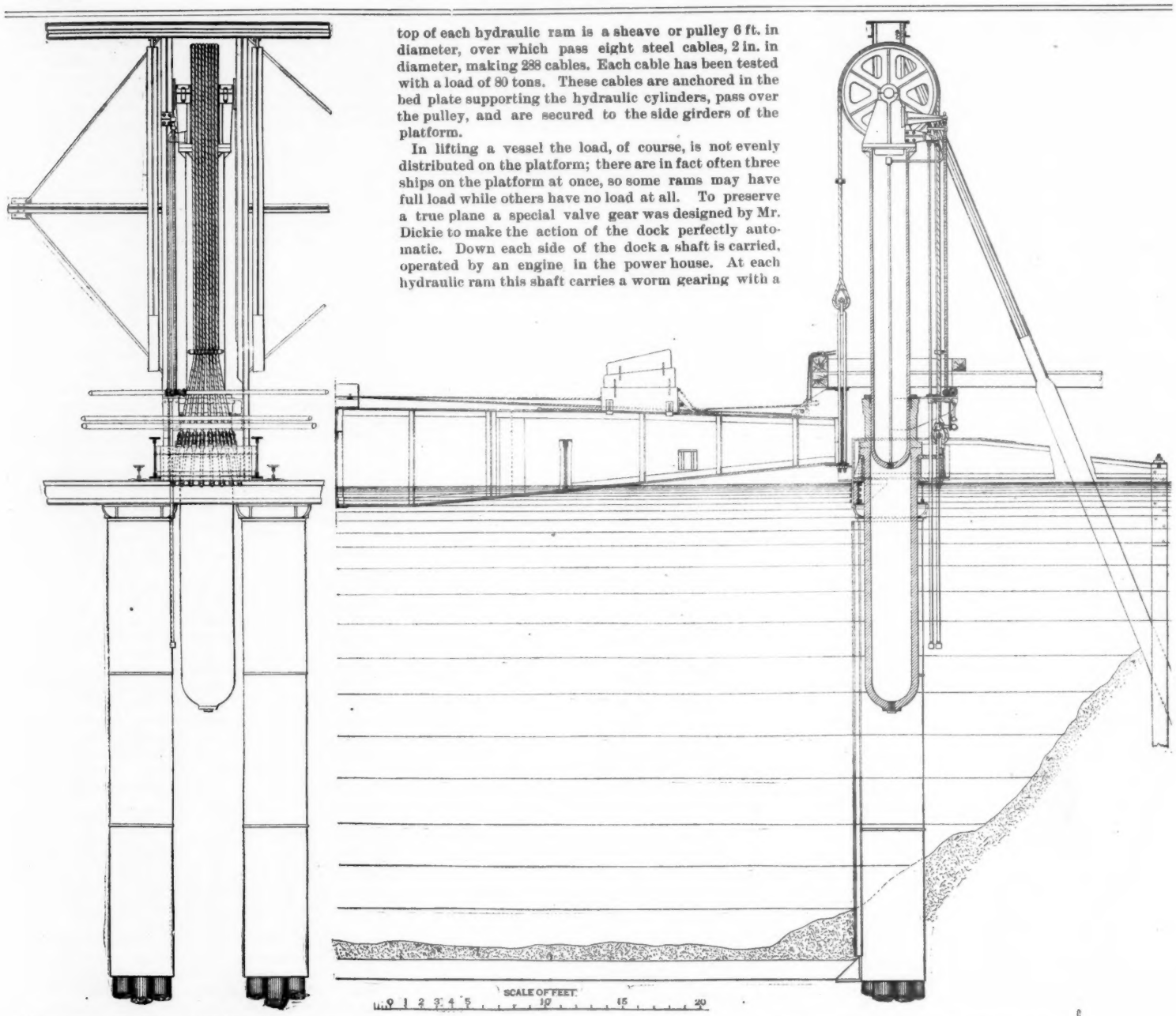
The average tensile strength of the steel was 4,050 kg. per square centimetre (about 55,700 lbs. per square inch), with 25.6 per cent. elongation in 8 in.

In view of all this the committee indorsed this steel as a material for bridge building. It recommended, further, that, in general, the steel should have a tensile strength of from 3,500 to 4,500 kg. per square centimetre (about 48,000 to 62,000 lbs. per square inch), with elongations of from 25 to 20 per cent. in 8 in., with a sectional area of test pieces of 5 square centimetres (0.8 sq. in.).

It is proper to say that we have not attempted here to follow the committee's report through all its details and tabulations of results. Those who are sufficiently interested to study it further will do well to consult the original, as published in the *Zeitschrift* of the Austrian Engineers' and Architects' Society. We have endeavored simply to give enough to enable some idea to be formed of the character of the work performed by the committee, and of the general results secured.



BRIDGE GIRDERS TESTED TO DESTRUCTION.



HYDRAULIC DRY-DOCK—UNION IRON WORKS, SAN FRANCISCO, CAL.

Hydraulic Dry Dock—Union Iron Works, San Francisco.

When the Union Iron Works, of San Francisco, moved their works from the old location in the heart of the city to a block of land on Mission Bay, some 22 acres in extent, the object was to be in a position to take advantage of the increasing steamship trade of the port, and provide facilities for carrying on a business, the principal item of which should be marine engineering and ship building. Chief among the requirements of such an establishment is a dry dock. Various forms of dry dock were considered in deciding what would be best adapted to the conditions of the business, and the nature of the ground upon which the dock would be built. The principal part of the docking business at San Francisco is for cleaning and painting, and most vessels are on the dock only for 24 hours, and for that reason getting the dock dry and the vessel dry in the shortest possible time is a matter of first importance. The site of the dock being on a mud flat with a depth of mud of from 80 to 90 ft. would render working in a graving dock very disagreeable, as such docks where much mud is carried in with the water require a long time to dry and clean out. The Union Iron Works therefore resolved to build a hydraulic lift dock from the designs of G. W. Dickie, the manager of the works.

This dock, which we illustrate, consists of a platform built of cross and longitudinal steel girders, 62 ft. wide and 435 ft. long, with keel blocks and sliding bulge blocks, upon which the vessel is lifted. The lifting power is obtained from a set of hydraulic pumps, working through a weighted regulator, the weight on which is increased as the load increases on the dock. There are 18 hydraulic rams on each side of the dock; these rams are 30 in. in diameter and have a lift of 16 ft. As the platform rises 2 ft. for 1 ft. movement of the rams, the platform can be lowered 32 ft. This gives 22 ft. of water over the keel blocks at high tides.

The foundations consist of 72 cylinders of iron, which extend from the top girders to below the mud line. These cylinders are driven full of piles, no pile being shorter than 90 ft. The iron cylinders are to protect the piles from the teredo, which is very destructive in the harbor of San Francisco. The hydraulic cylinders are carried on girders resting on the foundation piers, the cylinders passing down between each pair of piers. On top of each hydraulic ram is a sheave or pulley 6 ft. in diameter, over which pass eight steel cables, 2 in. in diameter, making 288 cables. Each cable has been tested with a load of 80 tons. These cables are anchored in the bed plate supporting the hydraulic cylinders, pass over the pulley, and are secured to the side girders of the platform.

In lifting a vessel the load, of course, is not evenly distributed on the platform; there are in fact often three ships on the platform at once, so some rams may have full load while others have no load at all. To preserve a true plane a special valve gear was designed by Mr. Dickie to make the action of the dock perfectly automatic. Down each side of the dock a shaft is carried, operated by an engine in the power house. At each hydraulic ram this shaft carries a worm gearing with a worm pinion on a vertical screw. This screw works in a nut on the end of a differential lever. This lever operates the inlet and outlet valves of the hydraulic rams, the valve box moving up or down with the rams, and the inlet and the out pipes sliding in stuffing boxes.

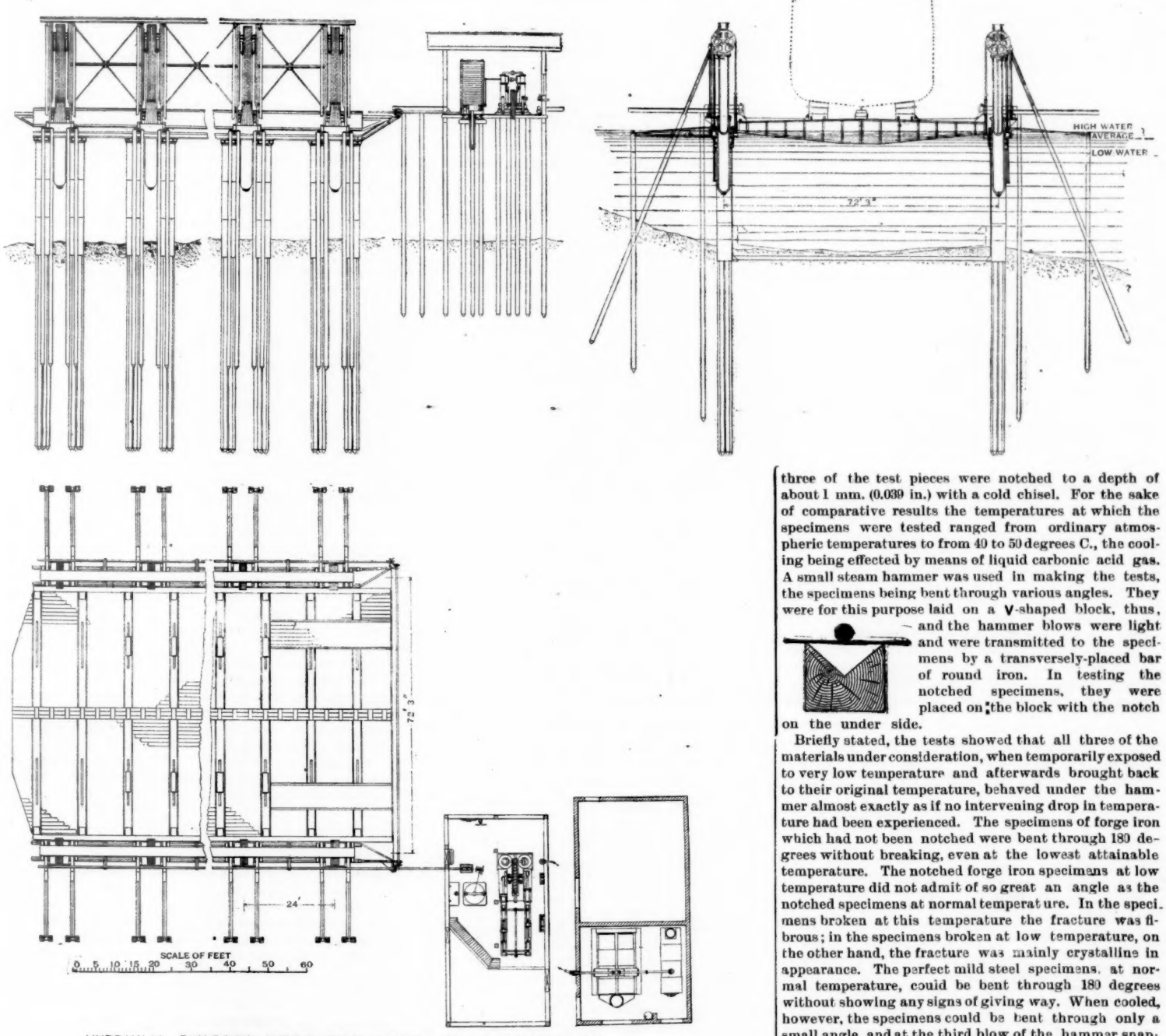
To lift the dock the engine operating the shaft is started, and with it the operating screws. These, through the levers, open the inlet valves. The rams then begin to move up. If any one has a light load it will go up ahead of the others, but in doing so it lifts the other end of the lever and closes the inlet valve. In fact, the screws are continually opening the valves,

while the motion of the rams are continually closing them, so that no ram can move ahead of the screw. To lower the motion is simply reversed. When the dock is up a line of locks on top of the foundation, 72 in number, is pushed under the platform by a hydraulic cylinder, and the platform lowered on to them where it rests until the work is done on the vessel, when the dock is again lifted, the locks drawn back, and the dock with its load lowered.

The construction of this dock was begun in the early part of 1886, and the first vessel was lifted June, 1887. The work done by this dock is as follows:

	Tonnage.
In 1887, from June 15 to Dec. 31, 47 ships	55,560
In 1888, 117 ships	114,493
In 1889, 120 ships	131,381
In 1890, 133	135,275
In 1891, up to Sept. 1, 102 ships	93,577

Making a total of 519 ships lifted, without any accident whatever, being an average of 10½ vessels per month. We doubt if many docks can show such a record of work.



HYDRAULIC DRY-DOCK—UNION IRON WORKS, SAN FRANCISCO, CAL.

The following are the principal data collected in convenient form:

Total length of girder	421 ft. 7 in.
" " platform on the keel	436 ft. 6 "
Width of platform	65 ft. 7 "
Maximum lift	29 ft.
" lifting capacity	6,000 tons
" per ram	164 "
Number of rams	36
" foundation columns	72
Distance between centres of rams, length way.	24 ft.
" " cross way	72 ft. 3 in.
Diameter of plungers	30.7 in.
Eight 2 in. diameter steel ropes per ram.	
Two 12×16 in. vertical steam engines for pumps.	
Four pressure pumps, 36-in. stroke, diameter of plungers	3¾ "
One Duplex steam engine for operating valves	6 × 6 "
One Worthington Duplex pressure pump	4½ × 15⅝ × 4 "
One Accumulator, 8 in. diameter of ram, 48-in. stroke.	
Weight on ram	12,000 lbs.
Weight of 11 pieces	47,500 "
Weight of ram	2,500 "
Total weight of accumulator	62,000 "
Average speed of pressure pumps, 31 strokes per min.	
Pressure for lifting { empty dock, 275 lbs. per sq. in.	
{ loaded " 1,250 " " "	
Speed of platform loaded, 3.2 in. per minute, with 1,250 lbs. per sq. in	
Steam pressure, 90 lbs. per sq. in.	

Dimensions of Wootten Compound Passenger Engine.

The following are particulars from the specifications for the Philadelphia & Reading engine illustrated in outline in our issue of Nov 13. The engine has Vauclain compound cylinders and Wootten firebox:

Boiler of Wellman steel 57½ in. diam., of suitable thickness to sustain a working pressure of 175 lbs. per square inch with a factor of safety of 8. Firebox of Wellman steel 113⅛ in. long by 96 in. wide. Combustion chamber 3 ft. 8 in. long.

Grates, water tubes with intermediate cast iron bars and two drop plates.

Tubes 324, 1¾ in. diam., 10 ft. long.

Total wheel base 22 ft. 10 in. Rigid wheel base 13 ft. 10 in.

Spread of driving wheels 8 ft. 10 in.

Driving wheels 78 in. diam.

Driving wheel centres 72 in. diam.

Driving axle journals 8½ in. diam. by 12½ in. long.

Truck wheels 48 in. diam. with journals 5¼ × 10 in.

High pressure cylinders 13 × 24 in.; low pressure cylinders 21 × 24 in. Vauclain type.

Estimated weight in working order about 112,000 lbs.

Estimated weight on driving wheels about 75,000 lbs.

Side rods, I section. U. S. metallic packing for piston rods and valve stems. P. & R. pattern steam reversing gear, bearings throughout Ajax metal. Westinghouse automatic driver and tender brake with air signal. Sellers' 1887 No. 9½ injectors. Truck wheels with steel tires. Tender 4,000 gallons capacity carried on eight steel tired wheels 33 in. diam. Tender axle journals 4½ × 8 in. Eight-inch channel iron tender frame. Detroit triple sight feed lubricator.

There has been trouble on the Reading with the Wootten engines in keeping the fine coal on the grate at high speed, and this has compelled the use of a higher grade of coal than is absolutely necessary to make steam; that is, on the slower moving engines the fine coal is all right and generates sufficient steam even for high speed work, but at high speeds the force of the blast is sufficient to pull the fine coal off the grate, and it has been necessary for this reason te use a larger size than is required to make steam. Possibly the new designs of compound, owing to the reduced force of blast, may burn satisfactorily the same size of coal that is used on the slower speed engine. It would seem reasonable to suppose that this would be the case; if so, the Reading will not only find the usual economy in compounding, but will also save in the price per ton of fuel used.

Low Temperature Tests of Iron and Steel.

Profs. F. Steiner and H. Gollner, of the German technical high school at Prague, have made a series of tests of iron and steel for bridges at abnormally low temperatures, and have published the results together with other interesting information bearing on the subject in the *Wochenschrift* of the Austrian Engineers and Architects' Society.

Forge iron, mild steel and English cast steel were tested, there being six test pieces of each in flat. The tests were all bending tests, and in every case three of the test pieces were notched to a depth of about 1 mm. (0.039 in.) with a cold chisel. For the sake of comparative results the temperatures at which the specimens were tested ranged from ordinary atmospheric temperatures to from 40 to 50 degrees C., the cooling being effected by means of liquid carbonic acid gas. A small steam hammer was used in making the tests, the specimens being bent through various angles. They were for this purpose laid on a V-shaped block, thus,

and the hammer blows were light and were transmitted to the specimens by a transversely-placed bar of round iron. In testing the notched specimens, they were placed on the block with the notch on the under side.

Briefly stated, the tests showed that all three of the materials under consideration, when temporarily exposed to very low temperature and afterwards brought back to their original temperature, behaved under the hammer almost exactly as if no intervening drop in temperature had been experienced. The specimens of forge iron which had not been notched were bent through 180 degrees without breaking, even at the lowest attainable temperature. The notched forge iron specimens at low temperature did not admit of so great an angle as the notched specimens at normal temperature. In the specimens broken at this temperature the fracture was fibrous; in the specimens broken at low temperature, on the other hand, the fracture was mainly crystalline in appearance. The perfect mild steel specimens, at normal temperature, could be bent through 180 degrees without showing any signs of giving way. When cooled, however, the specimens could be bent through only a small angle, and at the third blow of the hammer snapped like glass.

The notched mild steel specimens, when cooled, snapped in two under the first hammer blow, and the fractures in both cases were crystalline in appearance. The cast steel specimens behaved in almost exactly the same way, and the fractures in the cooled specimens were quite coarse grained. All the specimens were 8 in. long, from 1.2 to 1.5 in. wide, and from 2.8 to 4 in. thick.

The manner in which the specimens were cooled to the very low temperatures observed is of interest. The carbonic acid flasks were placed in an inclined position in a box at the side of the steam hammer, and were kept cool by means of ice, their mouths pointed downward. The test specimens were placed, in their order, in a "cooling bag." This was a piece of hose about 20 in. long and 5½ in. in diameter, inclosing another hose section of the same length, but only about 4¼ in. in diameter. One end of this double hose was tied securely around the neck of the carbonic acid flask, and the other end was firmly tied up after the test specimen had been inserted. By opening the graduated cock on the carbonic acid flask the liquid acid could be admitted into the bag. The first portions of acid which entered instantly vaporized and

escaped through the envelope, absorbing so much heat that succeeding portions of the acid were retained in the form of snowy crystals. By closing the valve on the flask and carefully kneading the bag, the test specimen within could be completely enveloped in this snowy mass. The double covering formed an admirable non-conductor, so that the solid carbonic acid could be kept in that condition for several hours. Each test specimen was kept in the bag for 30 minutes, additional supplies of carbonic acid from the flask being introduced from time to time. The specimens, when required, were removed by means of tongs, first untying the lower end of the cooling bag. The specimens, on removal, immediately became covered with a thick layer of frost, which formed again after being scratched off. This would last for about ten minutes. Contact of the fingers with the cooled specimens or with the solid acid caused painful burns—hence the necessity of caution in handling. The temperature in the cooling bag was determined approximately by means of an inserted alcohol thermometer. For future experiments it was concluded to measure the temperature by inserting in the cooling bag an iron test piece, to be afterward immersed in a certain volume of absolute alcohol. From this volume, and from the observed reduction of temperature, the temperature of the test piece can be calculated.

Baldwin Compound Locomotives.

Up to a recent date the Baldwin Locomotive Works had received orders for 115 compound locomotives on the Vauclain system. The following table gives a list of these orders. They are interesting, indicating as they do the extent to which the introduction of the compound locomotive has already developed on this continent. To these should be added the two cylinder engines, built by the Schenectady, Brooks and Rhode Island Works, and by several railroads and the Johnstone engines built by the Rhode Island Works.

The Brazilian government ordered in December, 1889, a compound consolidation locomotive for the Bahia Extension Railroad. After a year's experience with that engine the order for four duplicate engines was placed. The 15 engines built for the Paulista Railway comprise four separate orders; the six for the New York, Lake Erie & Western comprise the one ten-wheel fast freight engine which is now being tested, and the five decapods each weighing 177,000 lbs. The two engines for the Lehigh Valley comprise one consolidation engine with modified Wootten firebox for Mr. A. Mitchell's division, and one 10-wheel engine for Mr. Kinsey's division. It is of interest that not only these two compounds, but the 20 engines now finishing for the Lehigh Valley road have hollow crank pins of steel, tempered in oil by the Harvey process.

The Philadelphia & Reading company's order for 21 engines comprises ten 75-ton consolidation engines and ten 62-ton fast freight locomotives. It includes also one fast passenger locomotive. This engine is intended for high speed. The low piston speed which will be afforded by the 78-in. driving wheels, and the soft exhaust from the compound cylinders, in connection with the Wootten form of firebox, will, perhaps, give a greater degree of economy than has ever been attained in similar service. The consolidation engine for tests by the Master Mechanics Association committee is practically a duplicate of that built for the Western New York & Pennsylvania. The ten wheel engine for that committee has driving wheels 72-in. diameter, and is specially designed for fast passenger service with heavy trains.

The locomotive to be constructed for the Sinnemahoning Valley Railroad will embody unusually novel features for American practice. It is to be an articulated engine having a total weight in working order of about 66 tons. It will be carried on two driving trucks, each with six wheels, and each fitted with four cylinders of the Vauclain type. The purpose of the design is to give the maximum power consistent with a limit of 11,000 lbs. per wheel in order to avoid crushing 40 lb. steel rails laid on stringers, and the stringers so supported as to prevent placing a load greater than 33 tons on a wheel-base of 20 ft. Exhaustive tests are to be made of this last engine, also of the Philadelphia & Reading fast passenger locomotive; the Cincinnati, New Orleans & Texas Pacific ten wheelers, the Central Railroad of New Jersey fast passenger locomotive and the two Lehigh Valley engines. The passenger locomotive for the Central of New Jersey will be similar in design to the fast Baltimore & Ohio eight-wheel engines with 78-in. wheels, excepting that the firebox will be placed over the frames for burning anthracite coal and the cylinders will be compound. The ten-wheel freight locomotive for the Central of New Jersey is of the same general dimensions as the one now running on the New York, Lake Erie & Western.

Speed of Milling Cutters.

The Browne & Sharpe Manufacturing Co., of Providence, R. I., has just issued a new treatise on "The Construction and Use of Milling Machines." What follows is an extract from the chapter on the "Speed of Mills."

It is impossible to give definite rules for the speed and feed of mills, and what is here said is only in the way of suggestions. The judgment of the foreman or man in charge of the machine should determine what is best in each instance. As usually the highest possible speed and feed are desirable, it pays to increase the speed and feed until it is seen that something will break or burn and then reduce to a speed and feed of safety. Sometimes the speed must be reduced, and yet the feed need not be changed.

The average speed on wrought iron and annealed steel is perhaps 40 ft. a minute, which gives about 60 turns a minute for mills 2½ in. diameter. The feed of the work for this surface speed of the mill can be about 1½ in. a minute, and the depth of cut, say $\frac{1}{16}$ of an inch. In cast iron a mill can have a surface speed of about 50 ft. a minute, while the feed is 1½ in. a minute and the cut $\frac{1}{8}$ of an inch deep, and in a tough brass the speed may be 80 ft., the feed as before, and the chip $\frac{1}{32}$ of an inch.

As a small mill cuts faster than a large one, an end mill, for example, ½ in. diameter can be run about 400 revolutions with a feed of 4 in. a minute.

For examples of what may regularly be done under suitable conditions, we may mention that mills 2½ in. in diameter used in cutting annealed cast iron in our works are run at more than 200 turns, or at a surface speed of more than 125 ft., while the work is fed more than 8 in. a minute. The cuts are light, not more than $\frac{1}{32}$ of an inch deep, and the work is short, from ½ in. to 1 in. long. Two side mills 5 in. in diameter, running 50 turns a minute, dress both edges of cast iron bars ¾ of an inch thick, with a feed of more than 4 in. a minute.

An English authority, Mr. Geo. Addy, gives as safe speeds for cutters of 6 inches diameter and upward:

Steel,	36 ft.	per min.	with a feed of	½	in.	per min.
Wrought Iron,	48 "	"	"	"	1	"	"
Cast Iron,	60 "	"	"	"	1⅜	"	"
Brass,	120 "	"	"	"	2⅝	"	"

And he gives as a simple rule for obtaining the speed:—Number of revolutions which the cutter spindle should make when working on cast iron=240 divided by the diameter of the cutter in inches.

Mr. John H. Briggs, another English authority, states: "For cutting wrought iron with a milling cutter taking a cut of 1 in. depth—which was a different thing from mere surface cutting—a circumferential speed of from 36 to 40 ft. per minute was the highest that could be attained with due consideration to economy, and to the time occupied in grinding and changing cutters; the feed would be at the rate of ⅝ in. per minute. Upon soft mild steel, about 30 ft. per minute was the highest speed, with ¼ in. depth of cut and ⅝ in. feed per minute. Upon tough gun metal, 80 ft. per minute, with ⅛ in. depth of cut and ⅝ in. feed. For cutting cast iron geared wheels from blanks previously turned, and using in this case comparatively small milling cutters of only 3½ in. diameter, the speed was 26½ ft. per minute, with ⅛ in. depth of cut and ¾ in. feed per minute.

Slotting cutters may often be run at a higher speed than other cutters of the same diameter, but with a wider face. Angular cutters must in some instances be used with a fine feed to prevent breaking the points of the teeth.

The Kellogg Seamless Tubes.

The Kellogg Seamless Tube & Mfg. Co., after three years of development, has lately been running its works at Findlay, O., on special material for use in making projectiles. The material was furnished to the American Projectile Company, of Lynn, Mass. The tubes are rolled in a continuous mill from hollow steel ingots made by the Kellogg company, and when finished are about 11 ft. long, 4 in. outside diameter, with walls .68 in. in thickness. These tubes are cut into lengths of about 16 in. for the body of the projectile. The points of hard steel are attached by electric welding. The butt end is closed up by forging process. This company claims to be able to make any size, thickness or length of weldless steel tubes by this process, within the limits of the present machinery, and samples are shown of perfect tubes of varying thickness between .68 and .12 of an inch and in diameter from 2 to 4 in. outside. Orders are now to be taken for thinner tubes, suitable for all work where strength, uniformity and smoothness are required.

The process by which these tubes are rolled is about as follows: A series of rolls placed alternately horizontally and vertically are driven by a chain of gears properly proportioned to give the desired speed to the different sets of rolls in the train. The speed of each pair of rolls is calculated so that it will receive the tube at a sufficiently higher rate of travel than the preceding rolls to permit the necessary elongation of the tube as it is compressed in the rolls. There are nine pairs of rolls and the last pair delivers the tube at the desired thickness. If a thicker or a thinner tube is desired the diameter of the sections of the mandrel between the rolls is changed. This mandrel extends the entire length of the roll train, and has enlarged sections at the rolls, which can be changed as desired. If an oval tube is wanted the rolls and mandrels are changed to suit. The ingots are cast hollow and are then put through blooming rolls, which reduce the thickness of the walls about one half; after this they are reheated and passed through the tube mill.

This product, as shown by the tests of samples, is an excellent one, and being weldless has many advantages for the hard service to which boiler tubes are subjected.

Tall Buildings.

At a recent meeting in Chicago of the sub-committee of the council committee on public buildings, appointed for the purpose of inquiring into the subject of extremely high buildings, General Wm. Sooysmith, speaking from an engineering standpoint, called attention to the great variation in the character of the soil as shown by many borings made in the central part of the city, and considered it unjust to limit by general ordinance the height of buildings, since one might be located upon very dangerous ground and another a very short distance away have an excellent foundation. The site of every building having a weight of over two or three thousand pounds per square foot of foundation should be carefully bored and examined and the plans of the building arranged accordingly. He predicts that in the near future builders will go down to hard material, and get foundations that will not settle at all. He considers the present method of fire proofing to be inadequate in case of a very hot fire within, and that the expansion will be so great as to seriously wrench the framing. Besides, the fire department is at present unable to raise water to the height demanded.

Mr. W. L. B. Jenney thought that buildings higher than twelve stories should be prohibited; not because higher ones were unsafe, but because of congestion of travel in the down town streets. So far as the safety of the buildings is concerned, Mr. Jenney thinks there is no danger so long as responsible architects are in charge. He advocates a schedule touching the fibre strength of the columns and beams employed, the strain, the weight per square foot, the weight of live and dead loads on each floor, and similar pertinent matters, this schedule to be answered to by the constructing architect and carefully examined

COMPOUND LOCOMOTIVES BUILT BY THE BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA

Road.	Number of engines.	Diam. of cylinders. In. H. P.	Diam. of cylinders. In. L. P.	Stroke. In.	Diam. of wheels. In.	Service.	Number of driv. wheels.	Number of truck wheels.
Baltimore & Ohio	1	12	20	24	66	Passenger	4	4
Bahia Extension R. R., Brazil	1	9	15	16	37	Freight	8	2
Mexican National	1	10	17	20	46	"	6	4
Northern Pacific	1	11½	19	24	56	"	6	4
Paulista Railway	3	10	17	24	62	Passenger	4	4
Oeste de Minas	1	7	12	16	37	"	4	4
" " "	1	7½	13	16	33	Freight	6	4
Mogyana Railway	1	9½	16	18	41	Passenger	6	4
Paulista	3	13	21	21	50	Freight	8	2
New South Wales	2	13½	22	26	51	"	8	2
Ramal Dumont	1	7½	13	18	36	"	6	0
Western New York & Pennsylvania	1	13	21	26	50¼	"	8	2
Paulista Railway	5	13	21	24	50	"	8	2
Central Brazil	3	11½	19	24	66	Passenger	4	4
" "	3	8	14	18	45	"	4	4
" "	3	12	20	24	55	"	6	2
" "	3	8	14	18	44	"	6	2
" "	2	13½	22	24	50¼	Freight	8	2
" "	3	10	17	20	37	"	8	2
Leopoldina	1	9	15	20	55⅛	Passenger	4	4
Los Angeles Terminal	1	11½	19	24	56	Freight	6	4
Pernambuco	3	9½	16	20	37	"	8	2
"	4	9½	16	18 20	39 45	Passenger Freight	6	2
New York, Lake Erie & Western	1	14	24	26	62	Passenger	6	4
Texas Central	2	11½	19	24	56	Freight	6	4
Bahia	4	9	15	18	37	"	8	2
M. M. Association (for tests)	1	13	21	26	51	"	8	2
Lehigh Valley	1	13	21	24	50⅝	"	8	2
"	1	12	20	24	55⅛	"	8	2
Buffalo, Rochester & Pittsburgh	2	13	21	24	51	"	8	2
Pennsylvania R. R. Co	5	13	23	24	50	"	8	2
Master Mechanics' Association (for tests)	1	14	24	24	68	Passenger	6	2
Leopoldina	1	10	17	20	37	Freight	8	2
New York, Lake Erie & Western	5	16	27	28	50	"	10	2
Philadelphia & Reading	10	14	24	28	50	"	8	2
Sinnemahoning Valley	1	9½	16	18	40	"	12	0
Cincinnati, New Orleans & T. P	2	13½	23	24	68	"	6	4
Central R. R. of N. J.	1	13	22	24	78	"	4	4
Philadelphia & Reading	10	13½	23	24	60⅝	Freight	6	4
"	1	13	22	24	78	Passenger	4	4
Lehigh & Lackawanna	1	11½	19	24	62	"	4	4
"	1	13	22	24	50	Freight	8	2
Paulista Railway	4	12	20	24	66	Passenger	4	4
Central of New Jersey	1	14	24	26	62	Freight	6	4
Mexican National	6	10	17	20	46	"	6	4
"	4	10	17	20	38	"	8	2
Pennsylvania & Northwestern	1	13	22	24	50	"	8	2
Total	115							

by the building department before the permit for any tall building is issued.

Mr. Henry Ives Cobb indorsed what had been said, and suggested the licensing of architects, the license to be revoked upon a neglect of any of its provisions for safety, thus preventing the incompetent or careless architect from following his profession.

Mr. Adler, of Adler & Sullivan, held that there is more danger from incompetent architects in low buildings than in high structures, because people putting a large sum of money into a building would be more careful in the selection of an architect.

It was generally agreed that there should be none but competent men in the architects' profession; that there should be a careful examination of all important plans by a competent board representing public interest; and that the site of all heavy buildings should be bored and tested, the plans of the building to be guided thereby.

Chief Sweenie of the fire department gave it as his opinion that all buildings too tall to be fully protected by the fire department should be provided with stand-pipes. Also that the greatest danger from fire was to be apprehended from small fires in the lower stories, which, though they in themselves do little damage, fill the halls and stairways above with smoke, thus making panics with great loss of life.

The following resolutions were adapted:

Whereas, The tendency to erect high buildings in this city has reached a point where, in the judgment of those interested in the building trades, a halt should be called; and

Whereas, It is believed by the Builders' and Traders' Exchange that the health and safety of the citizens of this city would be best protected by the passage of an ordinance limiting the height and providing for a rigid inspection of buildings; and

Whereas, We believe that if the present tendency to high buildings in the business district is permitted to continue the streets will, within a limited period, become inadequate to accommodate the people, therefore be it

Resolved, That we recommend to the committee of the city council now having charge of this question the introduction and passage of such an ordinance as will serve to remedy what we believe to be a growing evil.

Car-Wheel Lathe.

The Pond Machine Tool Co. has developed a decided improvement in the art of turning down steel-tired car wheels, by means of which it is claimed that the amount of work done per hour is quadrupled, thereby rendering the use of steel-tired wheels more economical than heretofore.

The main central gear has a segment which is removed to allow the pair of wheels to be rolled in place, and then restored, and simply and firmly locked. The latheman makes this transfer without help in one-half minute.

The driving mechanism is beneath the lathe, protected from dirt and chips and the possibility of injury to the workmen. The initial power is transmitted to the large gear shown in the centre from a cone having a variation of speed adapted to the different sizes of car wheels. This method of transmission is patented, and necessitates the use of only two pairs of spiral gears, by which the power is multiplied 250 times. This arrangement allows abundant room for the workman and his tools, and—a most important consideration—permits the chipping out of hard spots to be done without stopping the lathe. The lathe is thus kept constantly at work and no time need be lost.

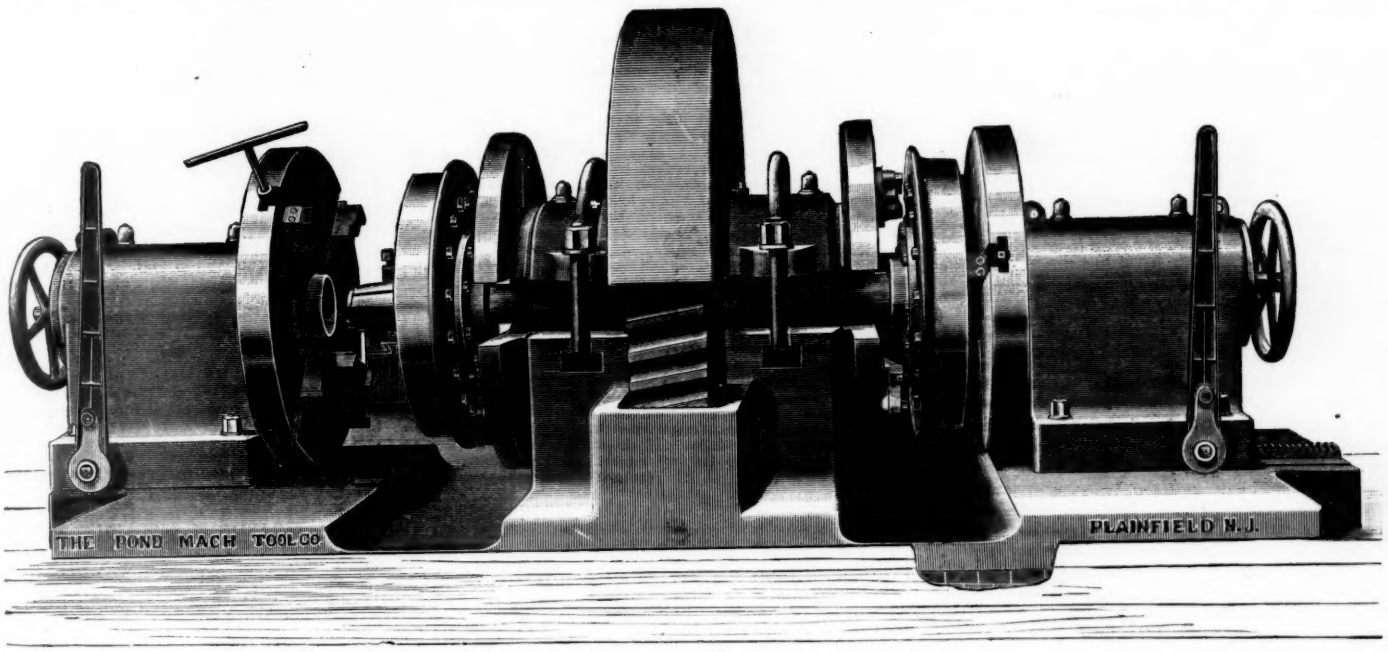
The face plates and journals are one casting, and the central driving gear is bolted to it, so that either is a simple piece to replace in case of accident. The teeth are 8 in. face by 1¼ in. thick, and the pinion is so placed that it engages four of these teeth all the time.

The delicate lathe centre is dispensed with, and the inner ends of tail spindles are bored conical sufficiently large to admit of segmental expanding sleeves, which are turned to fit the conical bore in the inner end of tail spindle, and bored to fit the axle journal.

In preparing to turn a pair of wheels, the tailstocks are moved back, by means of levers shown in the cut, far enough to admit the axle; the segmental expanding sleeves are slipped on the journals; the segment of large driving gear being removed, the wheels are rolled into position and the segment replaced and locked; the tailstocks are moved forward, the taper bore in tail spindles receiving the taper segmental expanding sleeves, thus contracting them, causing them to slightly grip the axle journal and centre it in the lathe; the tailstocks are then secured to the bedplate by means of the bolts shown, and further compression and rigid adjustment of the segmental sleeves obtained by means of the hand wheels on the outer ends of the lathe; and an equalized lateral adjustment of the axle, to allow the engagement of the chuck jaws with the under side of the tire, is also obtained at the same time.

The tail spindles and the axle when in position are practically one piece, and with the tailstock chucks gripping the underside of the tire, an absolutely rigid and solid adjustment is secured, which insures the wheels running true with the journals after turning.

Wheels of 42 ins. or smaller diameter can be turned without removing from the axle, and can be placed in the lathe and adjusted ready for turning in fifteen minutes without the use of a crane. The patent driving dogs are of such construction that they need not be removed when changing wheels, and will drive without spring or chatter. The lathe is symmetrial and attractive in outline.



LATHE FOR TURNING STEEL-TIRED CAR WHEELS.

Adhesion of Railroad Spikes and Lag Screws in Ties.

In our issue of May 1, 1891, appeared a paper by Mr. James E. Howard, giving the results of experiments at the Watertown Arsenal on the holding power of spikes. We are now enabled to supplement the data then given by the results of some independent experiments published by A. J. Cox in *The Transit*, University of Iowa. The two sets of experiments were conducted in practically the only possible way, by driving spikes into various kinds of wood to varying depths and noting the power required to pull them out. The woods selected at the Watertown Arsenal were yellow pine, white oak, hemlock, chestnut and white cedar, while Mr. Cox confined his experiments to white oak (seasoned and unseasoned) and unseasoned white cedar, adding however the bayonet spike and Hill's curved spike to the ordinary spike, which was the only one used at Watertown. As might naturally be expected the results are somewhat at variance.

At Watertown a ⅝-in. square spike driven into a white oak tie 4.7 in. required a strain of 4,200 lbs. to start it. With Mr. Cox, in 20 tests of common spikes newly driven in a seasoned Missouri white oak tie, the average resiftance was 5,514 lbs.. the length of the spike in the tie being about 4⅝ in. Further a spike driven into a white cedar tie at Watertown to a depth of 4.9 in. gave a resistance of 2,300 lbs., while with Mr. Cox the common spike driven into the same kind of wood to a depth of 4⅝ in. showed only 1,140 lbs. resistance. The figures demonstrate that there is a wide variation in the holding powers of spikes, depending on the denseness of the wood, the degree of compression of the fibers (up to certain limits), and the condition of the surface of the spike; a smooth bright surface not holding like a rougher, rusted one. Care, also, in driving will have great effect upon the ultimate strength, for blows of the hammer falling obliquely upon the head will throw the spike out of line, enlarge the hole, crush the fibers on one side more than the other, and thus materially decrease the holding power. It has been noticed, too, that spikes driven straight usually exhibit greater maximum resistance than if driven obliquely. This is probably due to the fact that the spike itself may bend in drawing or may crush the fibers of the wood on one side to such an extent that the holding power of the fibers on the other side is entirely or partly destroyed.

The only point of comparison in the two lag screw experiments lies in the use of a ⅝-in. screw driven into a ½-in. hole in white cedar. At Watertown, at a depth of 4.9 in., the maximum resistance was 2,610 lbs., while with Mr. Cox this resistance was 3,405 lbs., variations that can best be accounted for by the difference in the timber upon which the experiments were made.

The following table gives a comparative résumé of the results obtained by Mr. Cox and at Watertown, including the resistacnes of the Hill and bayonet spikes, both of which will be found to be somewhat in excess of the common spike, for hard woods, while the bayonet is less in the softer white cedar.

	Cox Experiments.		Watertown Experiments.	
	Maximum resistance.	Resistance per sq. in. of area.	Maximum resistance.	Resistance per sq. in of area.
Seasoned white oak:				
Common spike	5,514	643	4,200	706
Common spike in ⅛-in. hole	4,936	575	6,600	1,100
Common spike re-driven	4,490	520	....	...
Common spike in ¼-in. hole	3,240	378	....	....
Hill curved spike	5,842	....	....	....
Bayonet spike	6,350	....	....	....
Unseasoned white oak:				
Common spike	4,706	548	....	....
Common spike in ⅛-in. hole	6,140	716	....	....
Hill curved spike	5,130	....	....	....
Bayonet spike	5,334	....	....	....
Unseasoned white cedar:				
Common spike	1,140	133	2,305	384
Common spike in ⅛-in. hole	1,400	162	....	....
Hill curved spike	1,775	....	....	....
Bayonet spike	955	....	....	....

We also reproduce Mr. Cox's table giving the results of his tests with lag screws:

Kind of wood.	Size screw.	Size hole bored.	Length in tie.	Max. resist. lbs.	Resist. per sq.in.	No. tests.
Seasoned white oak	⅝ in.	½ in.	4½ in.	8,037	1,024	3
Seasoned white oak	⅝ "	½ "	3 "	6,480	1,223	1
Seasoned white oak	⅝ "	½ "	4½ "	8,780	1,230	2
Yellow pine stick	⅝ "	½ "	4 "	3,800	484	2
White cedar, unseasoned	⅝ "	½ "	4 "	3,405	434	2

In figuring area for lag screws, the surface of a cylinder whose diameter is equal to that of the screw is taken. The length of the screw part in each case was 4 in.

In looking over all of these experiments it appears that for a ⅝-in. spike of the common pattern, carefully driven in an oak tie for a depth of 4 in., it is not safe to count upon a resistance of more than 3,000 lbs., which is just

below the minimum obtained where pains were taken to have everything all right. To be sure we may have 7,000 lbs. or over, as Mr. Cox obtained; but it is not the highest notch touched under the most favorable conditions that determines what can be reproduced in all kinds of weather with all kinds of wood and under the manipulation of men more or less skilled in spike driving. It is evident, too, that the crushing of the wood varies, and it would have been interesting and valuable had the experimenters examined the condition of the fibers after each test and learned how they acted and what effect their arrangement had on the pulling resistance of the spike. These tests also show the marked falling off in the resistance of redriven spikes, and that the boring of holes in the tie also lessens their holding power.

As for lag screws the variations should not be quite so great, and, indeed, we find that in a yellow pine stick Mr. Cox secured 3,800 lbs. resistance for a ⅝-in. screw, let in 4 in.; while the Watertown tests gave 3,510 lbs. at a depth of 3.8 in. though the former was run into a ½ in. hole and the latter into the solid. If we should consider the latter screwed in to a depth of 4 in. and give it a proportional increase of resistance, it would pull at 3,759 lbs., a variation of only 41 lbs. from Mr. Cox's results. Hence it would seem that we could safely depend upon a strain of at least 3,500 lbs. as the pulling resistance of a ⅝-in. lag screw when driven to a depth of 4 in. in yellow pine, while the same experiments show that 6,000 lbs. is well within the limits for white oak. But this brings up another phase of the subject. The cross-sectional area of a ⅝ in. lag screw is 0.3 sq. in. and the safe working strain ought not to exceed 12,000 lbs. per sq. in., or 3,600 lbs. for the screw. Therefore we may conclude, in a general way, that lag screws in yellow pine or the harder and denser woods, to a depth of at least 6¼ times their nominal diameters may be depended upon to hold with safety a load equal to the safe working strains of the metal from which they are made.

Relative Merits of English and American Locomotives.

In view of the large amount of attention given in various quarters to the discussion of the relative economies connected with the operation of locomotives in England and in the United States, our readers will be interested in a series of articles which Mr. M. N. Forney has commenced in the *Railroad and Engineering Journal*, entitled "English and American Locomotives." The first appeared in the November number and contains valuable statistics showing the comparative mileage and coal consumption of the two classes of locomotives as well as the relative values of the fuels used. We reprint here the substance of this first paper.

Table I. contains all the data relating to the performance of British locomotives which *The Engineer* gave last November. Table II. gives similar but fuller information concerning the working of American locomotives. It should be observed that the first table, giving the performance of British locomotives, covers a period of a half year only, whereas the second, relating to American locomotives, covers a whole year.

In *The Engineer* of July 24, its editor says, rather triumphantly, "that every attempt that has been made by writers on the subject to prove the superiority of the American locomotive has been so far a dead failure." Our cotemporary does not refer to the fact that it has been clearly shown that the maximum coal consumption per sq. ft. of grate per hour of American locomotives is more than twice as great as that of English locomotives, and that the quantity of water evaporated is nearly in the same proportion. On the authority of our contemporary we have it that "about 75 lbs. (of coal) per square foot of grate per hour may be regarded as a *maximum consumption*." We have shown consumptions of 121.6, 132.2, 148.1, and 193.7 lbs. of coal per square foot per hour, and Mr. Dean, in experiments made on the Union Pacific, burned over 200 lbs.* We have shown an evaporation of water equal to 739.12 lbs. per square foot of grate per hour with a poor quality of coal. Mr. Dean, on the Old Colony, evaporated over 1,000 lbs. with good coal. It will be shown farther on that this greater capacity for burning coal and generating steam has an important bearing on the cost of transportation.

Our esteemed disputant remarks, in a recent article, that "what we have written on the subject has, no doubt, elicited a great deal of information which American engineers did not before possess." It seems as though some information, elicited by what has been written on this side the Atlantic, must be new, if not to British engineers, at least to our cotemporary. We submit that some advantage may be claimed for our locomotives, if they are capable of burning more than twice as much coal and evaporating nearly the same proportion of water, and can consequently pull greater loads than locomotives which do not generate a corresponding amount of steam.

But a study of what we may call our international tables will reveal some other information which perhaps British engineers "did not before possess." In these tables it will be seen that the number of locomotives owned by the different companies is given in the second column, the total mileage in the third, and the average mileage in the fourth. At the foot of this column the aggregate average mileage is given. This is obtained by dividing the total engine mileage by the number of engines. In Table II. the total number of all locomotives capable of service and owned by different American railroad companies is given. Whether the table of English engines gives *all* the engines owned or only those in service we are unable to say. It will be seen though that the average mileage of British engines for a half year was 12,305, equivalent to 24,610 miles per year. The average of nearly 15,000 American locomotives, as shown by our table, was 35,650 miles. When facts of great importance are announced simply by two sets of figures, they often do not convey an adequate idea of their significance. We therefore represent graphically the relative average mileage of locomotives here and on the other side of the water by the following diagram in which the lengths of the dark lines represent the proportionate average service which British and American locomotives perform annually:

AVERAGE ANNUAL MILEAGE OF ENGLISH LOCOMOTIVES.

24,610 miles.

AVERAGE ANNUAL MILEAGE OF AMERICAN LOCOMOTIVES.

35,650 miles.

To show the *maximum* mileage, we have obtained from a number of different roads the greatest distance run by each of three engines, which ran farthest during the last year. The results are given in Table III.

We have seen the report of the remarkable mileage of the "Charles Dickens" on the London & Northwestern, which ran a million miles in less than 10 years, or an annual mileage during that time of over 104,000 miles, which exceeds anything in our table. The figures which we give are, however, taken from ordinary every-day practice of 33 different roads. Can *The Engineer* give its readers a report similar to ours of the maximum mileage of English locomotives in ordinary service?

It seems hardly necessary to dwell upon the advantage which American locomotives possess over their Anglican contemporaries, in their greater capacity for doing what they are made for—that is, for running and pulling trains. If we were arguing about horses, it would be apparent that an animal which would travel, on an average, 35 miles per day was a much more serviceable and more valuable beast than one which would travel only 24 miles, even though the one which could travel farthest ate more oats than the other. The same thing is true of locomotives. Railroad companies buy, build and own them for the service they can perform. That is what gives them value. Our adversary, apparently, entertains—vaguely, perhaps—the idea that the "chief end" of a locomotive is to evaporate the largest quantity of water per pound of coal. A maximum evaporation of water is of some importance, but to a railroad company, crowded with traffic, and an insufficient equipment, the *service capacity* of their locomotives is paramount to everything else. Its influence on the interest account is a matter of simple calculation. Supposing a road, say in some new country, is equipped with 250 American locomotives. These, at $8,000 each, would cost $2,000,000. To do the same work, 375 English locomotives would be needed at a cost—assuming the same price—of $3,000,000. That means, of course, $1,000,000 more capital and an annual interest charge of $50,000, without any allowance for deterioration. It also means more engine-house capacity, more men to take care of engines, more yard and shop room, and a very great addition of expense in the locomotive department.

The last number of "Poor's Railroad Manual" gives the total number of locomotives owned by the railroads of the United States at 32,241. If the annual mileage of American locomotives did not exceed that of their English contemporaries, 46,704 locomotives would be required to do the work which the 32,241 are now doing. That is, 14,463 *more* than are now owned would be required to do the work of our railroads. At $8,000 apiece, this additional equipment would cost $115,704,000.

The remark of *The Engineer* that "every attempt that has been made by writers on the subject to prove the superiority of the American locomotive has been so far a dead failure," has already been quoted. It says, "The facts are too strong." Now, we submit to our esteemed adversary and to our readers the question whether a $115,000,000 fact has not "considerable" strength.

COAL CONSUMPTION.

The strong point which *The Engineer* has dwelt upon during the discussion of the relative merits of our locomotives and theirs has been the greater economy of their locomotives in the consumption of coal. From our tables it will be seen that the average consumption on British roads, for the half year covered by Table I., is 37.53 lbs. per engine mile, whereas on the American roads, of which the consumption is reported in column 9 of Table II., the average is 74.37, or almost exactly twice as much as that of the British engines. If this consumption was of coal of the same quality, and in doing the same amount of work, and if the relative merits of locomotives depended entirely on the fuel consumption, it would, of course, be a bad showing for our engines.

With reference to the quality of American coal, we have taken occasion before to say that it varies within very wide limits. Through the courtesy of Mr. Leeds, Superintendent of Machinery of the Louisville & Nashville Railroad, we are able to give the relative consumption of 16 different kinds of coal, as determined by careful, practical tests in running passenger trains on that road. The comparison is made with good Pittsburgh coal, which was rated at 100. The consumption was as follows:

TABLE IV.—VALUE OF DIFFERENT KINDS OF COAL.

Coal No. 1.	Pittsburgh (good),	Consumption		100.
" 2.	"	"	"	109.79
" 3.	"	"	"	112.84
" 4.	"	"	"	117.05
" 5.	"	"	"	124.33
" 6.	"	"	"	125.03
" 7.	"	"	"	128.84
" 8.	"	"	"	129.75
" 9.	"	"	"	131.21
" 10.	"	(poor)	"	134.83
" 11.	"	"	"	138.29
" 12.	"	"	"	138.57
" 13.	"	"	"	139.49
" 14.	"	"	"	149.04
" 15.	"	"	"	162.61
" 16.	"	"	"	181.05

From this table it will be seen how widely the coal which is used in this country differs in quality and value. It is by no means certain that the poorest coal tested by Mr. Leeds is the worst that is used, as he only experimented with fuel available for his own road. Evidently it would be idle to expect that an engine

TABLE II.—SHOWING THE LOCOMOTIVE EXPENDITURES OF THE UNDERNOTED RAILROADS IN THE UNITED STATES AND CANADA FOR THE YEAR 1890.

1. Name of Road.	2 Number of locomotives owned by company.	3 Total mileage of locomotives for year.	4 Average annual mileage of locomotives.	5 6 Average number of cars per train. Pass.	Fr't.	7 8 Coal consumed per engine mile. Pass.	Fr't.	9 Pass. and fr't.	10 Cost of fuel per engine mile.	11 Cost of repairs per engine mile.	12 Cost of oil, waste and miscellaneous supplies per mile run.	13 Wages of engineer, fireman and cost of cleaning per engine mile.	14 Total cost of locomotive service per engine mile.
								lbs.	cts.	cts.	cts.	cts.	cts.
Boston & Albany*	210	5,979,896	24,916	.....	.....	.....	.....	69.00	.....	4.40	0.56	.....	.....
Boston & Mainet	448	11,934,272	26,661	.....	.....	.....	.....	47.50	10.14	3.11	0.39	6.74	20.38
Burlington, Cedar Rapids & Northern	104	3,424,314	32,926	3.65	15.40	.....	.....	75.00	5.73	3.87	0.41	6.91	16.92
Canadian Pacific	532	17,474,438	32,847	.....	.....	.....	.....	62.00	11.0.	3.83	0.39	6.50	21.79
Chesapeake & Ohio	268	8,797,269	36,963	4.52	18.90	63.65	127.39	.....	4.02	4.54	0.29	6.59	15.44
Chicago & Alton	207	7,044,699	34,032	5.20	20.32	72.3	96.1	80.00	4.31	3.63	0.60	8.00	16.53
Chicago, Burlington & Quincy	473	19,259,373	40,717	4.99	18.22	.....	.....	82.71	5.72	4.70	0.35	7.04	17.81
Chicago, Milwaukee & St. Paul	757	27,636,934	36,504	.....	.....	.....	.....	70.90	7.21	3.82	0.26	6.86	18.15
Chicago, Rock Island & Pac.	534	19,242,100	36,034	.....	.....	.....	.....	60.00	5.77	3.07	0.32	6.57	15.73
Chicago, St. Paul, Minneapolis & Omaha	230	7,031,562	30,572	.....	.....	.....	.....	70.00	10.17	3.94	0.38	7.14	21.63
Chicago & Northwestern	803	30,495,691	37,833	.....	.....	.....	.....	78.70	7.14	3.67	0.35	7.00	18.16
Cincinnati Southern	226	7,684,118	34,000	4.30	22.80	55.00	98.00	71.90	5.80	4.40	0.50	7.40	17.90
Cleveland, Cincinnati, Chicago & St. Louis	438	15,723,929	35 899	4.50	21.40	63.21	106.72	80.29	5.69	3.19	0.32	6.78	15.98
Del., Lack. & Western	244	8,147,097	33.389	.....	.....	.....	.....	78.00	5.99	3.56	0.46	5.81	15.52
Fitchburg	221	6,304,182	28.52§	.....	.....	.....	.....	71.90	10.89	4.61	6.66	9.27	25.43
Illinois Central	383	18,605,304	31,775	4.49	15.36	74.9	108.4	90.60	4.59	3.34	0.28	6.46	14.67
Kan. City, Ft. Scott & Mem.	149	4,770,148	32,014	.....	.....	.....	.....	60.30	5.21	4.12	0.24	7.14	16.71
Lake Shore & Mich. South.	549	19,509,322	35 536	.....	.....	.....	.....	62.80	4.36	4.84	0.16	6.84	16.20
Louisville & Nashville	462	17,990,571	38,940	5.11	13.11	60.5	93.3	.....	7.16	5.17	0.27	7.98	20.58
Michigan Central	420	16,200,768	38,573	5.50	32.00	72.71	128.00	.....	6.93	3.96	0.26	5.33	15.88
Mil., Lake Shore & Western	100½	3,933,620	38,929	.....	.....	.....	.....	75.70	10.64	2.56	0.31	6.64	20.15
Missouri, Kansas & Texas	212	8,559,852	40,376	4.80	16.91	.....	.....	83.10	8.32	4.66	0.42	7.93	21.33
Missouri Pacific	303½	10,825 213	35,033	4.56	18.32	.....	.....	87.00	6.99	4.77	0.45	7.73	19.94
Mobile & Ohio	98	3,137,528	32,019	.....	23.4	.....	.....	63.40	3.86	3.97	0.35	6.90	15.08
New York Cen. & Hud. River	800	27,456,016	34,320	5.00	33.90	.....	.....	.....	.....	2.61	0.33	6.25	.....
New York (Manhattan) El.	250	8,541,037	34,164	4.56	.....	47.85	.....	47.85	8.90	1.70	0.30	8.62	19.52
New York, Lake E. & Wes.	556	19,672,746	35,383	4.90	21.80	85.00	122.4	.....	6.83	5.32	0.41	8.18	20.74
New York, New Haven & Hartford	190	7,963,161	41,927	.....	.....	.....	.....	60.00	8.48	3.61	0.64	7.37	20.10
New York, Penn. & Ohio	254	8,153,297	52,099	5.10	19.10	70.00	117.9	.....	5.68	4.17	0.31	7.60	17.76
Ohio & Mississippi	116	4.605,967	37,982	.....	.....	.....	.....	73.60	3.54	3.59	0.20	6.78	14.11
Old Colony†	227	6,558,675	28,893	.....	.....	.....	.....	55.80	11.18	3.49	0.58	7.54	22.79
Pennsylvania (United R. Rs. of New Jersey)	385	12,076.374	31,341	4.94	23.67	82.4	108.8	78.40	11.59	6.21	0.72	6.45	24.97
Pennsylvania (Philadelphia to Pittsburgh)	991	31,648,320	31,936	4.95	24.37	67.5	136.00	100.60	5.75	5.38	0.50	6.22	17.75
Pennsylvania Lines West of Pittsburgh (N. W. System)	441	16,188.889	36,710	5.33	23.87	58.87	100.36	.....	5.00	4.96	0.32	6.74	17.02
Philadelphia & Erie	186	5,268,503	28,325	3.84	32.66	60.00	153.8	124.30	7.41	6.29	0.38	6.16	20.24
Philadelphia, Wilmington & Baltimore‡	193½	7,505,439	38,788	4.40	17.40	.....	.....	62.00	8.50	6.05	0.58	5.62	20.75
St. Louis & San Francisco	169	5,570,373	32.690	.....	.....	.....	.....	80.10	5.89	4.85	0.34	7.59	18.67
Union Pacific	909	34,846,343	38,334	5.16	16.36	.....	.....	94.50	10.25	6.60	0.45	9.14	26.45
Wabash	403	15.099,843	37,468	4.79	22.13	.....	.....	71.24	4.53	3.17	0.35	7.11	15.16
Western New York & Penn.	121	3,959.957	32.727	3.30	20.40	.....	.....	78.70	5.06	3.76	0.37	6.55	15.74
Wisconsin Central	134	5,089,187	37,979	.....	.....	.....	.....	75.80	9.19	3.46	0.25	6.92	19.82
Totals	14,863½	519,889,130	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Averages	.....	.....	35,650¶	.....	.....	.....	.....	74.37¶	.....	4.25**	0.39††	7.06**	18.87‡‡

* This company has a large number of old locomotives, too light for its service, which make little mileage.
† A considerable proportion of the engines of this company are not employed in winter.
‡ The engines and mileage on the Baltimore & Potomac are included here.
§ This average is obtained by dividing by the total number of miles run by the total number of engines.
¶ This is the result of multiplying the number of miles run on each road by the quantity of coal burned and adding the products thus obtained and dividing by the sum of the mileages on all the roads.
** This average is obtained in the same way as that at the foot of column 9, but using the cost of repairs per mile run on each road as a multiplier.
†† This is the average of the averages of each road.
‡‡ This is obtained by multiplying the total cost of locomotive service per mile run on each road by the total number of miles run and adding the products together and dividing by the number of miles run on all the roads.

* The coal used on the Union Pacific is of a very free-burning quality.

using the No. 16 coal would burn as little per mile as another would which used "good Pittsburgh."

We have no direct testimony bearing upon the relative value of English and American coals, but all the information received from persons who have had experience both here and in England, is to the effect that the coal used there is much better than the average here, especially better than that used in our Western States. In 1844 Professor Johnson made a series of elaborate tests on coals for the Secretary of the U. S. Navy. These were probably the most complete experiments ever made on American coals. He also tested a few samples of English and Scotch coals. Without going into minute fractions his conclusions may be summarized by the following figures:

Water evaporated per lb. of	Scotch coal	6⅝ lbs
" " "	Liverpool (England)	7 "
" " "	Pittsburgh (Pa.)	7 "
" " "	Newcastle (England)	7¾ "
" " "	Cumberland (Md. and Pa.)	8½ "

These figures give some idea of the relative value of these different coals. It should be added that Pittsburgh and Cumberland coals are among the best in this country for steam generating purposes. All Western coals are of poorer qualities, descending almost to incombustibility.

The impossibility of making any comparison which will be conclusive of the relative economy of locomotives using fuel varying so widely in quality as that which is used on English engines and in this country must be obvious.

From Table I. it will be seen that the consumption on the Scottish roads averages 46.04 lbs. per mile, or nearly 30 per cent. more than on English lines, with the probability, too, that trains in Scotland are lighter than in England. This is due to a great extent, probably, to the poor quality of coal used there.

In our next article we will make some comparison of the loads hauled on British and American railroads, and of the relative cost of repairs in the two countries, and also of the cost of locomotive service per ton of train hauled per mile.

TABLE I.—SHOWING THE TRAFFIC RECEIPTS, ALSO LOCOMOTIVE EXPENDITURES OF THE UNDERNOTED RAILROADS OF ENGLAND, IRELAND AND SCOTLAND FOR THE HALF YEAR ENDING JUNE 30 AND JULY 31, 1888.

	English roads, totals.	Irish roads totals.	Scottish roads, totals.	Total U. K.
2 Number of locomotives	11,888	520	1,665	14,073
3 Total mileage of locomotives for half year	144,440,046	5,990,077	22,732,215	173,171,338
4 Average mileage for half year	12,150	11,537	13.653	12,305
5 Traffic receipts per train mile, passenger	£24 3s. 10d.	£81 3s. 4d.	£41 3s. 4d.	£30 3s. 9d.
6 Traffic receipts per train mile, freight	£07 5s. 11d.	£25 6s. 1d.	£25 5s. 3d.	£08 5s. 10d.
7 Coal consumed per engine mile.	36.61 lbs.	27.39 lbs.	46.04 lbs.	37.53 lbs.
8 Cost of fuel per engine mile	2.90 cts.	3.65 cts.	2.22 cts.	2.84 cts.
9 Cost of repairs per engine mile	5.54 "	4.74 "	3.82 "	5.30 "
10 Cost of working per mile run	10.92 "	9.26 "	8.62 "	10.58 "
11 Total cost of locomotive service per engine mile.	19.36 "	17.65 "	14.66 "	18.72 "

TABLE III.—GREATEST ANNUAL MILEAGE OF LOCOMOTIVES ON DIFFERENT ROADS

	Miles.	Miles.	Miles.
Western New York & Pa	51,269	50,572	50,157
Chicago & Alton	51,433	50,026	46,968
Kansas City, Fort Scott & Gulf	55,538	50,436	45,351
Old Colony	55,832	55,098	54,238
Canadian Pacific	57,156	56,466	56,399
Mobile & Ohio	59,000	48,446	44,289
Wisconsin Central	60,784	48,628	47,399
Chicago, Milwaukee & St. Paul	60,928	60,523	59,888
Missouri, Kansas & Texas	61,729	58,763	54,190
Wabash	61,785	59,625	57,823
Delaware, Lackawanna & Western	63,581	60,500	60,374
Milwaukee, Lake Shore & Western	65,750	63,660	61,970
Illinois Central	66 428	64,837	57,081
Ohio & Mississippi	16,498	65,200	64,349
Manhattan	67,785	57,729	56,725
Boston & Albany	70,217	67,965	66,781
Cincinnati, New Oricans & Tex. Pac.	70,356	67,850	66,857
Chesapeake & Ohio	71,084	50,053	49,756
Burlington, Cedar Rapids & Northern	71,630	51,980	51,360
Pennsylvania (United railr'ds of N.J.)	74,268	.....	.....
Michigan Central	77,913	76,272	75,196
Philadelphia & Erie	79,568	.....	.....
Union Pacific	80,198	79,650	73,763
Fitchburg	81,262	69,177	52,196
Atchinson, Topeka & Santa Fe	83,076	81,243	73,919
Lake Shore & Michigan Southern	86,155	83,038	79,251
Pittsburgh, Fort Wayne & Chicago	86,240	84,642	81,854
Pennsylvania (Philad'ip'a to Pittsb'h)	86,635	.....	.....
Missouri Pacific	88,240	63,127	57,654
Philadelphia, Wilmington & Balt	91,680	88,044	84,576
Louisville & Nashville	*96,541	88,904	87,909
Chicago, Burlington & Quincy	97,257	95,425	91,414
New York Central & Hudson River	97,384	95,096	93,662
Chicago & Northwestern	99,207	87,299	69,633

* This engine was in service only nine months, and made thi mileage in that time.

Elevated Terminal Facilities in Chicago.

The "Torrence Terminal" ordinance recently passed by the Chicago City Council and signed last week by Mayor Washburn, permits the Chicago Elevated Terminal Company to construct and operate a railroad with two or more main tracks and the necessary side tracks, switches, turnouts, etc., over such lands as it now has or may hereafter acquire, and across all streets, alleys and public ground along the following route:

Beginning at a point on the southerly side of Twelfth street, between the westerly side of State and the South Branch of the Chicago River, and extending southerly to a point adjacent to Sixty-seventh and State streets, thence in a southerly direction east of State street to the city limits. Also beginning at some point on the above-described route between Sixty-third and Sixty-seventh streets, thence in a southeasterly direction to a point on the state line between Illinois and Indiana. Also from a point on the first described main route between Twenty-second and Thirty-first streets, in a southwesterly or westerly direction to the city limits, crossing the said limits at some point between Fifty-fifth street on the south and Thirty-fifth street on the north.

The main tracks and the branch line running in a southwesterly and westerly direction as far as the intersection of the Illinois and Michigan Canal with Thirty-first street, shall be an elevated structure with the tracks supported by cross girders, which shall be upheld by rows of iron posts or columns, but outside of the street lines, upon the property of the company, may be supported by iron posts or brick or stone supports. The longitudinal distance between columns, when the same are within the street lines, shall be subject to the direction and approval of the Commissioner of Public Works of said city. Guard rails shall be placed at the side of the structure to prevent the cars from leaving the track after derailment.

Except where the width of any street or avenue between the curbs is 50 ft. or more, or where the structure is one having a row of iron columns or posts upon or near the curb lines, every cross street or avenue shall be spanned by a single span only. No part of the girders of the superstructure shall be less than 16 ft. above the established grade of streets, avenues or alleys, and whenever the elevated structure crosses or passes over the right of way of tracks of existing surface steam railroads a clear head room between the lower chord of all of said girders and of the surface rail of all of said railroads at the present existing grade, and from out to out of said right of way shall not be less than 18 ft.

Surface Track Provisions.—The tracks may be brought to the surface at a gradient to be fixed by the company itself in the vicinity of Sixty-seventh and State streets, and also the branch line in the vicinity of Thirty-first street and the canal.

Whenever the tracks shall cross streets now existing or hereafter laid out at a point or points of such gradient or gradients the company shall separate the grades as the Commissioner of Public Works may require.

The tracks laid on the surface must be raised after a period of twenty years. The company shall maintain at its own expense suitable fences along the branch routes where said railroad tracks are not elevated, together with gates and bells at the several street crossings along the routes where said railroad tracks are not elevated, with the necessary attendants in charge.

The company shall submit plans and specifications thereof to the Commissioner of Public Works for his approval, and its work shall proceed under the supervision of the Board of Public Works. The motive power shall be fully equipped with all modern devices calculated to render it practically noiseless and smokeless and to prevent the discharge of cinders and sparks, and suitable and practicable devices shall likewise be placed at all street crossings where the road is elevated to intercept and carry off storm water and drippings from melting snow and other sources by means of suitable instrumentalities to connect the same with the sewers of the city.

The company is to construct neat and commodious passenger stations of easy and convenient access, which stations and the architectural details and the general designs thereof shall be of recognized excellence and approved by the Commissioner of Public Works.

Two miles of the tracks authorized shall be constructed within three years from the passage of the ordinance.

The company gives a bond of $200,000 for the performance of its duties under the ordinances, and is obliged to deposit $100,000 with the City Treasurer until two miles of track are constructed. The ordinance must be accepted within 90 days.

New Webb Compound for the London & Northwestern.

Mr. F. W. Webb, Chief Mechanical Engineer of the London & Northwestern, has just completed a new compound locomotive, the "Great Britain," for that road. It is intended for the heavy fast passenger traffic between London and Carlisle on the West Coast route to Scotland. This engine is identical in principle with Mr. Webb's other compound engines. It has two ndependent driving axles, one connected to a pair of high pressure cylinders, and the other connected to a single low pressure cylinder placed inside the frames. The engine is an eight-wheeler, with one pair of leading wheels fitted with Mr. Webb's radial axle box and trailing wheels in fixed pedestals. The link motion is the ordinary curved link type for the high pressure cylinders, with Mr. Webb's single eccentric motion for the low pressure cylinders. The boiler has a longer barrel than usual. The tubes are divided into two lengths by a combustion chamber. The back tubes are 5 ft. 10 in. long and the front tubes 10 ft. 1 in. long. The combustion chamber can be reached from the bottom through a manhole. Following are the principal dimensions:

High pressure cylinders	15 in. × 24 in.
Low pressure cylinders	30 in. × 24 in.
Driving wheels	7 ft. 1 in. diameter.
Leading and trailing wheels	4 ft. 1⅛ in. diameter.
High Pressure Cylinder.	
Steam ports	11 × 1½ in.
Exhaust ports	11 × 3 in.
Travel of valve	4 in.
Outside lap	⅛ in.
Inside lap	0
Low Pressure Cylinder.	
Steam ports	20 × 2¾ in.
Exhaust port	20 × 5¼ in.
Travel of valve	5½ in.
Outside lap	1⅛
Inside lap	0
The valves are all of the piston type.	
Diameter of boiler	51 in.
Heating Surface.	
Fire box	120.6 sq. ft.
Combustion chamber	39.1 sq. ft.
Front tubes	853 sq. ft.
Back tubes	493 sq. ft.
Total heating surface	1,505.7 sq. ft.
Grate area	20.5 sq. ft.
Steam pressure	175 lbs. per sq. in.
Weight of Engine in Working Order.	
On front drivers	34,720 lbs.
On back drivers	34,720 "
On front truck	28,672 "
On rear truck	18,592 "
Total weight in working order	116,704 "

The running time between Crewe and Rugby and Rugby and Euston is 41.18 and 44.59 miles per hour, respectively. This is taken from a trip made Nov. 4. The total weight of train, including 25 coaches, engine and tender, was 856,912 lbs.

The engine consumed on this journey 37.5 lbs. of coal per mile, and the water evaporation per pound of coal was 10.96 lbs. The total length of the train, including the engine and tender was 934 ft. *Engineering* of Nov. 13 contains a cut of the locomotive and a very complete description.

THE SCRAP HEAP.

South American Railroads.

Among the projects for railroad construction in Colombia the Bureau of American Republics is informed that the line to connect Medillin in Antiequia with the River Magdalena is likely to be carried out. This road is about 62 miles in length, of which 25 are already constructed. It starts from Puerte Berrio on the above river, traverses a marshy country, and then goes over a mountainous region to Medillin.

The Venezuelan government has granted to Henry F. Rudhoff, a citizen of the United States, a concession for a road commencing at the city of Puerto Cabello, and extending via San Felipe to Araure, supplemented by a further concession to continue the line to Guanare, a total distance of 350 kilometres. Guanare is the capital of the State of Zamora.

The work on the railroad from Puerto Plata to the interior of Santo Domingo is being actively prosecuted. Substantial bridges of masonry and iron have been built over the Los Mamoyes and Palla-Casnao rivers and others are now in the course of construction in the canyons of Los Cacos and Luperon. The rails have been laid down beyond La Palla, and there is the greatest interest in the progress of the work. The road bed is being leveled and ballasted on the whole length of the line. This road is giving employment to a large number of native laborers, whose work is considered very satisfactory by the engineers in charge of the enterprise.

The Bureau of the American Republics has been informed that a contract has been entered into between the Government of Paraguay and Mr. Manuel Obert de Thiensies for the construction of a railroad from Asuncion to the Brazilian frontier, with branches. This road is to be built within four years. The government guarantees the payment of six per cent. interest on $30,000 for each kilogram of the road, and the company will also have free right of way, and may establish colonies on public lands. All the necessary machinery, cars and other supplies may be imported free of duty. This road is intended to be a part of a transcontinental line from Asuncion to Santos, on the Atlantic Ocean, and will pass through the towns of Embascada, Arroyos, San Estanislao and Villa Igatimi.

The Government of Brazil is advertising for proposals to extend the Porto Alegro Railroad about 250 kilometers and bids will be opened at Rio de Janeiro, Dec. 22.

Railroad Passes of the Cascade Range.

Colonel H. C. Ward, who was one of the principal engineers in the employ of the Northern Pacific in making the surveys of the Cascade passes, being asked about the Skagit pass, which is reported in local papers as having been decided upon as the one which is to be used by the Great Northern to reach Puget Sound, says in an interview with the Seattle *Telegraph* that he does not think the Skagit pass practicable. The same would hold good in the matter of the Packwood or Cowlitz pass. This pass ascends gently on the east side, so that nothing less than a 10-mile tunnel would materially reduce the summit elevation. On the west side the fall is about 300 ft. to the mile, to the valley of the Cowlitz, but the attempt to cross the Muddy Fork and reach the Nesqually, as recently suggested, is, he says, out of the question. There is a descent of 3,000 ft. from the summit to the forks, and a rise of 1,500 ft. in eight miles to the Nesqually. He did not regard the Natchez Pass with much favor, and while he said the Snoqualmie is the lowest of all the passes in the Cascades between the Fraser and Columbia, it would require a tunnel 3½ miles to bring about a feasible grade. The Stevens Pass is most southerly, 4,140 ft. in elevation; the Charlton, six miles north, is 4,200 ft.; one mile north of that is the Cady Pass, 5,300 ft., and about five miles north of that is the Ward Pass, 4,300 ft. This last pass, he says, has been rediscovered and named the Cady Pass, by later engineers. It will require a tunnel about two and a half miles long to make the Stevens Pass practicable. Any of these last named passes will be practicable, but the heavy grades will be long.

Irrigation in the Eastern United States.

The *Irrigation Age* has been calling attention recently to the value of irrigation for farm lands in the Eastern United States. Mr. J. W. Sanborn, following up the discussion, states that it has been tried upon at least one extensive farm in New Hampshire, with greatly increased crops as a result. He also points out the value of irrigating waters in conveying plant food in solution to the growing crops. There is no doubt that in many parts of the East irrigation works would pay the farmers handsomely. The average annual rainfall in many sections will not reach 40 inches, and the majority of this precipitation occurs in the months when no crops are growing. If water were supplied equivalent to about five inches per month during the season when it is needed most, the farmer would have more to sell and the railroads just so much more to carry.

To Enlarge the Polk Street Station in Chicago.

The Polk Street Union Station, in Chicago, is to be remodeled and enlarged so as to increase its capacity for trains about two-thirds. The station itself will not, after the improvements are complete, be used for storing passenger-cars. New storage yards have been built at Eighteenth street. The station is used as a passenger terminal by the Atchison, Monon, Wabash, Chicago & Eastern Illinois, and Chicago & Grand Trunk.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The "boycott" of the Chicago & Alton is not dead, and it is probably true that, as its friends say, it is not even dying; but the agreement not to pay commissions, which is the foundation of the "boycott," seems to be slowly weakening, and the press reports from Chicago claiming that the agreement of the roads east of Chicago has virtually gone to pieces, doubtless have a good many real facts to justify them. No one succeeds in proving anything in a regular meeting, but the continued payment of commissions just outside the fence gives such fine opportunities to pay inside that no one believes they are not improved. Still, the disposition of the larger roads to put up with a moderate amount of under-handed cutting by the weaker lines, which, as shown by developments in the freight department, has slowly become more marked as the local business of the strong lines has become heavier, will doubtless postpone any outward change for a good while yet.

The relative values of driving wheel tires of different degrees of durability has been considerably discussed of late, notably by a correspondent in the *Railroad Gazette* of Nov. 13; and the point at issue is concerning the decrease in cost of repairs. It is claimed that increased durability is profitable not only directly, but indirectly by preventing unnecessary repairs, which are often made simply because the engine comes into the shop. There is a weakness in this argument, however, due to a change in conditions within the last few years. It is no longer a universal practice to make the turning of the tires a signal for general repairs of the engine, for the reason that on the best roads tire-turning does not call an engine into the shop at all. When the tires need attention the engine is side-tracked and they are removed by any of the several different schemes for removing tires without removing the wheels. In order to determine what the cost is for changing tires in this way, we have collected some estimates made by railroad men. We find that there are railroad repair shops where a locomotive can be side-tracked in the morning and a true set of tires placed on the engine and the engine put in service at noon. A careful estimate of the cost for this work is less than $12. The time taken is about five hours. To do this it is necessary to keep tires in stock and have them ready to be put in position when the locomotive is sent in. The tires that are taken off are turned on a boring mill and made ready for the same or another engine. In this way tire turning or renewal is entirely independent of general repairs, and is done whenever necessary with but a short delay.

The greatest factor in the relation of tire service to general repairs is the flange brake shoe. Take the Ross-Meehan for instance; its success is beyond question. We know of innumerable instances where tires were badly worn, having "double flanges," which were reduced to a good running condition by the application of this shoe. A flat spot is invariably reduced by the application of this form of shoe. Of course the evil will not be entirely remedied, but it is always much lessened. On one large Western road having over 3,000 miles of line it has been found that with the proper use of a flange brake shoe there is no need of turning ordinary locomotive tires oftener than once in two years. If the tires be turned on a boring mill and the removal and replacing be performed with any of the modern apparatus for this work the total cost will be $12 for each removal, or $6 per year. Several other estimates confirm the conclusion that from $6 to $10 a year will cover the cost of turning locomotive tires when a flange brake shoe is used. The examination of a considerable number of tires ready for turning, with the records of previous turnings, shows that the flat spots, on the road just referred to, do not average more than ¼ in., and therefore are not large enough to be perceived by the engineer. It is not supposable that they can appreciably injure the other parts of the engine by causing jarring. A conclusion which may be drawn from the foregoing is that the main advantage derived from the use of a superior quality of tire is to be found simply in the increased durability; that is, the tires must stand on their own merits. If they are better and worth more money, they are so because they have an increased life, and not because they indirectly save repairs to the other portions of the engine. A set of tires, as shown by the correspondent referred to, will last about 10 years, and will cost, less scrap value, about $85. This is at the rate of $8.50 per year. Add to this the cost for removals for turning ($6) and we have as the cost of tires for an eight-wheel locomotive, $14.50 per year, under these conditions any saving that can be made by using a more durable tire will have to be some percentage of this cost per year, and not several times that amount, as has been claimed.

It has been observed by those who watch the introduction of the vertical plane coupler that it is not being applied in passenger service as fast as in freight. Of course this is true, for it has to meet competition in passenger service from the Miller coupler, an excellent device, which has done good service and is still high in favor, even with those who are advocates of the vertical plane coupler for freight service. The Miller is automatic; it is probably more durable than any other coupler in existence, and costs less for repairs than anything that has been offered for passenger service. It is so supported that it wears but little. The two faces do not chafe one against the other as in the vertical plane; hence, there is but a slight increase in the slack between passenger cars when equipped with a Miller coupler after having been a long time in use. On the other hand, the vertical plane coupler wears rapidly, and something must be done to give the knuckles greater durability for this class of work. Recent records kept by a large Western road appear to show that the knuckles do not average three months in constant use before they have to be renewed, and during the last half month their use is questionable owing to the close approach to the limit of safety in the coupler itself. Nevertheless, there are strong practical reasons why the passenger and the freight coupler should be uniform; the Miller will never be adopted for freight cars, and as a sequence the M. C. B. will be more and more used on passenger cars. The one great obstacle to its rapid introduction in passenger service is, as said above, the excessive wear of the coupling faces.

The new Vauclain 10-wheel compound locomotive on the Erie road is being thoroughly tested by Mr. A. E. Mitchell, the company's engineer of tests. The engine is being used in passenger service and has so far shown good results. The boiler is of the Wooten type. The apparatus is unusually complete. The indicators are driven by a special parallel motion and are so arranged that the cord can be drawn taut and the card taken without unhooking the cord. A pyrometer is placed between the deflecting plate and the tube sheet. A vacuum gauge is located on the side of the dome. A super-heating calorimeter is inserted into the dome and it extends to the throttle opening. Thompson water meters are placed in the injector feed pipes on each side to measure the volume of the feed water. All the measurements are being taken with great care and the results will doubtless show very accurately the value of compounding locomotives for passenger service.

Tests of Baldwin 10-Wheel Express Locomotive on the Baltimore & Ohio

Water Measurements by Meters.—There has been much conjecture as to the possibility of using water meters to measure the feed water for locomotives. All have acknowledged that if they could be made feasible it would be extremely convenient. The experience of these tests goes to show that a water meter is not only possible, but perfectly feasible on locomotives, and all of the expected advantages incident to its use can be realized. Too much cannot be said in praise of the Thomson water meter. So far as could be determined by these tests, its action and accuracy are perfect. All systems of checking the meter were found to be less accurate than the meter itself. Not once did the meters fail to operate, although the road was rough and no unusual care was taken in placing them. Nevertheless, it is not well to be careless in mounting these meters. All pipes should be thoroughly cleaned before they are put into position, and a sufficiently large strainer should be placed between the meter and the tank. A most essential feature is to have a good flap check valve between the injector and the meter; otherwise, the hot water may flow backward and ruin the rubber recording disks in the meter.

The convenience of this apparatus will be appreciated from the fact that it was not necessary to weigh the tender nor to take any account of the amount of water put in at water stations. It was only necessary to note the water line in the boiler and the water meter at starting. At any time during the run, the rate of feeding can be determined by looking at the meter. The amount of water put from time to time in the tank at the various water stations has no effect on the results, as only that amount of water is recorded which is used through the meter. Water taken to wet down the coal and to wash off foot plates does not affect the measurements. With this device and a large graduated pail under the overflow which collected all of the waste water, it is evident that all the feed water put into the boiler was measured within the limits of accuracy of the meters. The limit is proved to be less than $\frac{7}{10}$ of 1%. So far then as feed water measurements are concerned, one need not go to the trouble of putting on water glasses or using floats. They are much less accurate than the meters and very inconvenient. The water glass measurements made in connection with these meter tests had a possible error of 2%, it being found impossible to read the glasses within ¼ of an inch in the short time during which the engine was stopped at a water tank owing to the movement of the water in the tank.

The principal inaccuracy connected with water measurements in locomotive tests lies in the determination of the water line. In the boiler in question there was a difference of five inches in height of water line, depending upon whether the locomotive was on the grade on which it worked or on a level at the top or bottom of the grade. This prevented accurate determinations of water line at any time when the engine was not standing on a level. Fortunately, in this particular instance, there was a level at the top of the main grade where a stop was made, which enabled the determination of the water line and the calculation of the amount of water used going up the grade.

When locomotive boilers are being fired hard the water rises above the normal level, and a measurement of water just after the injectors have been throwing comparatively cold water into the boiler is not an accurate one; the water shrinks and swells according as the firing is hard or as the locomotive is being worked. Hence, measurements taken under these variable conditions are necessarily approximations. There is also a continuous movement of the water in the water glass, and a mean of the oscillations is not quite satisfactory. Although the amount of water fed into the boiler can be determined exactly by the use of meters yet the inaccuracies of the location of the water line render water measurements on short runs almost impracticable. The ten-minute test for a stationary engine is considered satisfactory when successive tests will give the same results; but in locomotive work, unless the engine be kept quiet, as it would be when tested in a shed, a short test is of little or no value. It may be accepted that a determination of the water line by the sound of the gauge cocks is too uncertain to be admissible in locomotive tests unless the run is a long one. In such cases the total amount of water used is so large that any errors in estimating the water level at the beginning or the end of the trip practically disappear.

Fuel Measurements.—The measurement of fuel in locomotive tests is not difficult so far as a determination of the total amount shoveled into the fire is concerned. A weighed amount may be shoveled into the tank, and the amount remaining after a given run be

weighed to determine the amount used, provided no water is used to wet down the coal. But it is next to impossible to determine the amount of coal used at any particular portion of a run when the coal is put in the tender in bulk. In these tests a plan was adopted which was simpler and permitted the estimation of fuel consumption during the run. Coal was put in sacks containing 125 lbs. each, with a small amount of weighed coal on the foot plate. Even with heavy firing it was found quite possible for the fireman to cut open the bags, and dump the coal on the foot plate as needed. In this way the rate of consumption on difficult portions of the run could readily be estimated. The use of water meters and of coal in sacks obviates any need of weighing the tender, and thus removes one of the largest inaccuracies incident to the ordinary locomotive tests. To determine the amount of fuel used during the trip, it was only necessary to count the number of bags which had been emptied.

However, the determination of the amount of fuel used during a run is not all that is necessary for a test. The measurement of the fire line before and after a test is very essential and extremely difficult. If the run is a long one, then the errors in the determination of the fire line may not be great; but for short runs there seems to be no way of measuring the difference between the heat value of coal in the fire before the test and after with sufficient accuracy to give reliable data. In tests such as this one made on a heavy grade, one trip closely succeeding another, it is, of course, impracticable to drop the fire and measure the amount of fuel in the ashes remaining. Such measurements are unsatisfactory and inaccurate in any case, because it is not practicable to draw the fire without wetting it, as the ashes rise into the machinery, and they are too hot to handle. When one run succeeds another within a short space of time some other method is necessary for measuring fuel used than by dumping the coal.

After reviewing all of the possible methods of measurements, it was decided to proceed as follows: A good fire was made in the engine and it was brought to a condition so suited to the fireman's wishes that he could get good work out of the engine on the heavy grade, which commenced almost immediately at the starting point. The fire was not brightened by any previous action of the exhaust, and could only be forced by the blower. Before starting, three persons estimated the height of the fire in the box. Necessarily, this fire was new, was not shaken down, and contained some ashes in the bottom, but throughout the fire there was a large percentage of combustible. At the top of the grate after a long hard pull there was a large amount of ashes in the bottom of the fire, and it had shrunk considerably. At this time enough coal was placed in the box to fill it up to the same height as at starting. An estimate was then made by the same three persons of the height and the amount of coal used on the run, including that needed to bring the fire up to the height determined upon. It may be well claimed by some that it is impossible to accurately measure the fuel used in this way. Of course, this is true; but of all schemes yet proposed, this seems to be the only one feasible for tests which succeed each other at short intervals. It may be remarked that in this particular case a comparison of the fuel used per ton mile in the different tests would indicate that there were no large errors in this method of determining the difference between the heat value of the fire before and after the tests.

Measurements of Smokebox Temperatures. — The pyrometer measurements were satisfactory as pyrometers go. They are necessarily, owing to the extreme heat and the difficulty of obtaining uniform conditions, somewhat inaccurate; but the results give a good general idea of the temperature of a locomotive smokebox when an engine is working hard pulling up a heavy grade, also when standing. As the force of the blast increased, there was in general an increase in the temperature of the smokebox; but owing to the variation in the thickness of the fire, an increase in vacuum made by an increase in the force of the blast did not necessarily produce an increased consumption of fuel or increased temperature in the smokebox. A thick fire and a light blast may result in a greater vacuum than would occur with a thin fire and a heavy blast.

A long pyrometer extending nearly across the arch is better than a short one, as it gives an average of temperature rather than a local temperature, such as would be recorded by a short pyrometer. Both a short and a long one were used in these tests. The long one gave the same uniform results. There are several different opinions as to the proper position for locating the pyrometer. In these tests it was placed between the tube sheet and the deflecting plate, and extended diagonally from low down on the outside to near the upper row of tubes on the inside. This seems to be a position which would give most nearly a correct average temperature. It is impossible to state just what the limit of accuracy is of the pyrometers used. Probably the limit is about 20 deg. Under what was as nearly as could be determined duplicate conditions, the device gave approximately duplicate readings.

In general pyrometer records are interesting, as they show the temperature of the smokebox and the possibilities of obtaining increased efficiency by using the smokebox as a superheater for steam or as a location for a feed-water heater. In these tests, in some instances, the temperature was over 1,000 degrees. In fact, the pointer on the gauge in one case turned until it touched the stop pin, which was located at about 1,200 degrees. This is altogether a higher temperature than is attained on the ordinary locomotive. The cause for the high limit in this case was the forcing of the engine to mount a heavy grade with its maximum load. A high smokebox temperature would certainly be expected with a fuel consumption of 172 lbs. per sq. ft. of grate per hour, and a cut-off in the cylinders about five-eighths of the stroke at a speed of 25 miles per hour, the vacuum in the smokebox varying from 12 to 16 in. This vacuum in inches corresponds to 6.9 to 9.2 ounces per square inch respectively.

Boyer Speed Recorder Diagram.—Too much cannot be said in praise of the action of the Boyer speed recorder in these tests. Its accuracy and reliability is without question when the device is properly mounted and cared for. It is not a delicate machine, and only needs ordinary attention. Its operation is well known to most of our readers. It consists of an oil pump which works against a fixed resistance in the shape of an aperture through which the oil flows. The faster the pump runs, the greater is the pressure in the oil cylinder. A piston in the oil cylinder which moves against a spring rises in proportion to the increase of pressure. As the piston rises, a metallic pencil marks the movement on a roll of prepared paper, which moves in proportion to the longitudinal movement of the engine. In the cab is a dial which indicates at all times the speed of the engine with only a small error. The diagrams given from these tests show the speed at all points on the grade. They record all stops and make an accurate record of the rate of acceleration. One noticeable advantage of this recorder is the indication of the variation in speed in running down hill. On such roads as the Baltimore & Ohio and some western roads having heavy grades, it is a constant care to the local superintendents to prevent engineers from running too fast down hill, and there is no means of checking them without some continuous record of the speed developed. On all heavy down grades it is customary to give a limit of speed in running down heavy grades to prevent the engineers from making up time at these points. Constant running on dangerous grades so accustoms the engineer and fireman to the conditions that they lose all fear and often do reckless running, which endangers the safety of trains. Such a device as this records the speed at all times and prevents any dispute between the engineers and conductors as to the speed attained.

Horse Power Measurements.—The measurement of the average indicated horse power was unusually accurate in these tests, as the cut-off was nearly uniform and at every period of change of five miles per hour in speed and at about every change in cut-off or steam pressure an indicator card was taken. The principal grades did not change materially from the bottom to the top, the speed was slow, and the resistance of the cars was about the same at all portions of the long grades. The calculated horse power determined from the per cent. of grade, the weight of the train, the speed, and the assumed friction of the train, approximated closely to the indicated horse power in the cylinders. Of this we shall treat more fully later. The distribution of the indicated horse power was shown to be on an average in one case on a 2 2 per cent. grade nearly as follows: To lift train up the grade, 84 per cent.; to overcome friction of train, 9 per cent.; to overcome locomotive resistance, 7 per cent.

As has been said before in these columns there is a need of some means of recording continuously the horse power developed in the cylinders. Several schemes have been proposed for taking a continuous indicator card and, of all forms of indicator, probably those with the diaphragm and without pistons are the best for this purpose. Such a one has been made and has been run continuously on a stationary engine for days at a time without damage. The main difficulty seems to be to provide a continuously moving paper which is so protected that it will not be damaged by water from the engine or in a rain storm, torn by the wind, or damaged by the pencil.

In these tests the highest horse power recorded was about 1,327. The train was moving at a speed of about 30 miles per hour and was being rapidly accelerated. We believe this to be the highest recorded horse power at the comparatively low speed of 30 miles an hour. The Strong locomotive on the Northern Pacific indicated 1,811 H. P. at 59 miles per hour.

There are interesting deductions which can be made from the data gathered during these tests, which we hope to present later.

One Cause of Brazilian Troubles.

Deodora da Fonseca, Dictator of Brazil, has resigned. Another temporary President assumes the reins, and there is prospect of peace. The Brazilians after all are a trustful people, in which they are in one sense peculiarly fortunate. This willingness to have peace if possible, and tumult and revolution only as a last resort under the lash of gross infringement of rights, is the cause that operates perhaps quite as strongly as any other to maintain Brazil undivided. She has little real political cohesion, but a great deal of political inertia, which is to a certain extent compensatory. The revolt in Rio Grande do Sul, and the agitation in the northern states, was accepted by some as an evidence of a probable breaking up of the new republic into several independent governments. This opinion proves to have been arrived at with undue haste, and yet we cannot fail to note that somewhat similar disturbances occurred on the occasion of the overthrow of the empire in 1889, although they assumed a less serious aspect then; neither can we ignore the fact that secession is freely discussed in various quarters, and that the opinion prevails among both politicians and merchants in the states of the extreme north and the extreme south that these states will ultimately establish their complete autonomy. Lack of political cohesion is, indeed, one of the most noteworthy circumstances in the condition of Brazil to-day.

In large measure the peculiarities of the railroad development of Brazil are responsible for this state of affairs. Outside of the government roads, concessions have been granted upon which about 6,000 miles of track has been built. At least 4,000 miles of this has proved unremunerative. The original expenditures upon these profitless railroads amounted in round numbers to $95,000,000, and Brazil has paid in guaranteed interest upon this sum to date another $65,000,000. Here is a grand total of $160,000,000 unwisely expended—an amount sufficient to have given Brazil three grand trunk lines, one north from Rio de Janeiro binding together all the central and northern states save Amazonas, a second doing the same for the southern states, and a third penetrating the western states of Goyaz and Matto Grosso, and affording communication with navigable water on the Rio Paraguay, or its tributary, the Rio Sao Lourenço. Instead of this Brazil has a large number of insignificant isolated railroads reaching back a short distance from the various important ports along her extensive coast line. These roads have unquestionably added some increments of trade to these ports, but they have done practically nothing toward developing the resources of the country, and they have rather intensified the feeling of separateness, and the aversion to the restraints and exactions of the central government, which have been growing for decades.

For example, Pará has for a number of years exported on an average about $16,000,000 worth of rubber, upon which an export duty of from 18 per cent. to 24 per cent. has been collected. More than half of this revenue goes to the treasury at Rio de Janeiro. The citizens of Pará have almost no commercial dealings with Rio; there exists no community of interests between Pará and any of the states south of her. In all but name she is independent, and she feels that independence would be cheaper and more conducive to her prosperty than union. The condition of Pará is duplicated in almost every state, except Minas Geraes and Sao Paulo, where trunk lines of railroad, with numerous ramifications, have established very close bonds with Rio de Janeiro. It is worthy of remark, also, that these are the only paying lines in the republic.

It was bad statesmanship to grant concessions for a host of detached roads which had no tendency to create for Brazil any great highways: but when all these wretched mistakes were made Brazilian statesmen knew very little about the true functions of railroads. They seemed to think that a railroad of itself meant prosperity, no matter where it was built. They had not learned that, like all good things, if wrongly applied it might become a detriment, a very dangerous thing in fact. Such has been the case in this instance.

The railroads have been a most onerous burden, an expense out of all proportion to any increase of commerce they may have effected, and they have not, with all their enormous cost, given to Brazil those arteries of interstate commerce which she so greatly needs, and which might have made her a prosperous and powerfully cemented nation that would not be in danger to-day of falling to pieces like a card house.

The most we can say is that we hope she will survive the storm and preserve her territorial limits unbroken, for it is to the advantage of every nation in the western hemisphere that no further subdivision shall occur; and when constitutional government has again succeeded martial law, we hope that Brazil will encourage only those railroad enterprises which tend toward giving her some bonds of unity, and that the new crop of wild schemes, born of the recently prevailing speculative fever, such as the Cuyabá–Itaituba scheme, the Cauetá-Goyaz scheme, the Ponta Grossa-Corumbá scheme, and the like, will be relegated to the shades of oblivion, to be replaced by others showing a better comprehension of national needs.

The Railroads of India in 1890.

The railroads of India are extended pretty steadily, but not what would be called rapidly in this country: 874 miles were opened in 1890, and the addition in the last ten years has been between 8,000 and 9,000 miles, which nearly doubled the mileage of the country, bringing it up to 18,879 miles at the close of last year, which is about equal to that of Illinois and Pennsylvania combined. The two states, however, have but about 100,000 square miles of area and 9,000,000 inhabitants, while India has 1,630,000 square miles and 263,000,000 inhabitants. That is, India is as large as the whole United States east of the Mississippi, plus all the territory west of it as far as Colorado, barring the Dakotas, and four times as populous as the whole United States, so that the railroads are as yet by no means crowded there, and they can be built for many years yet at the rate of the last ten years without becoming so. Yet for a long time nearly all the Indian railroads were unprofitable. To secure their construction the government had to guarantee five per cent. dividends on the capital invested, and for a long time it had to make good its guarantee on nearly all the lines. They have now become, on the average, reasonably profitable, though they do not yield quite five per cent. on their cost, but in these days the government could doubtless get all the necessary capital for 3½ per cent. or less. In 1890 the average return was 4.85 per cent., and in 1889 4.93 per cent.

With so few railroads and such a large territory and immense population, we should naturally expect a dense traffic. Actually, the Indian railroads have on the average what would be considered here a light freight traffic, but a very heavy passenger traffic, there having been last year equivalent to the movement each way daily of 403 passengers and 296 tons of freight over the entire system. The bulletins recently published by the Census Bureau for three districts in this country show nowhere so heavy a passenger movement (the heaviest being 332 each way daily in New England, while in the territory between Pennsylvania and Ohio it was only 119). But against the Indian freight traffic of 296 tons each way daily, the railroads of New England had 489 tons, those of the group west of Pennsylvania 780 tons, and those of the Middle States 1,699—the latter being nearly six times as heavy as the Indian freight traffic. Of course there can be no comparison of the number of people who furnished this traffic. The traffic per inhabitant must be hundreds of times as great here as there.

In adapting railroad service to this Oriental population, the English have had to modify profoundly their home practices. In England fares—at least regular fares—are the highest in the world. (The enormous traffic of season ticket and excursion passengers makes us hesitate to affirm this of average English fares, and there are no statistics either of movement or of any average rates.) But in India the vast majority of the population could never travel at all at English rates, or at any but very low rates; and the railroad managers have given them what they could afford to pay for, with the lowest fares in the world. This, it should be observed, has not made the natives of India a traveling people: in fact, very few of them ever travel; but it has made it possible for enough of them to travel to give the few railroads in that enormous population a very heavy passenger traffic. The passenger traffic, too, grows continually, while the freight traffic does not always, and in 1890 was less than in either of the two years previous.

The average rate per mile for the two lowest classes of passengers is only 0.6 cent, which would make the fare from New York to Chicago by the shortest route $5.47. For the second-class the rate is 1 cent, and for the first 2.90; but as 97½ per cent. of all the passengers were of the two lower classes, the 2.3 per cent. who went second-class and paid a cent a mile and the ½ per cent. who went first-class scarcely had any effect on the average rate. How is it possible for passenger traffic to pay at 0.6 cent per mile? Simply by having big trainloads, and in India the *lowest* average passenger trainload reported on any railroad was 158, which is about three times the average in this country, and the highest was 302. With such an average trainload passenger traffic would be profitable at the Indian rates in this country.

The average rates on freight are much higher than here; but some traffic is carried at rates not very much higher than our trunk line rates, especially wheat from the interior to the seaports, when it is taken long distances. However, the average rate on all freight in 1890 was 1.57 cents (but only 1.48 in 1889). The average freight-train load seems to have been 126 tons, and the average earnings per freight-train mile $2.04, which would make our railroads rich. The expense per train mile (all trains) is reported as 1.97 rupees, which is about 95 cents in silver currency, but not more than 75 cents in our currency. The gold cost is considerably less than ours. The earnings per train mile were just twice as great as the cost, giving the very comfortable net earnings of 95 cents silver or (say) 75 cents gold per train mile. If the railroads of our Middle States had been able to make as much, their profits in 1889 would have been $39,000,000 greater than the $91,000,000 which the Census Bureau reports them to have been, and they could have trebled their dividends.

The 16,228 miles of Indian railroads worked in 1890 employed no less than 262,693 men, or an average of 16.2 per mile. In the Middle States, where traffic is heaviest in this country, the number is 11.2 per mile, and in New England, where the traffic is more nearly like that of the Indian lines (passenger traffic one-sixth lighter and freight traffic two-thirds heavier) it is 7.1 per mile. Per employé there were 18,192 passenger miles and 13,357 ton miles in India; in New England 31,291 passenger miles and 46,853 ton miles, so that the Yankee railroad man seems to be decidedly more efficient than the Indian. And it is really the Indian with whom he is compared here, for no less than 96 per cent. of the employés of the Indian railroads are natives. These people work for very low wages. They are intelligent in many respects, and have gradually displaced the white employés, who, in the early days of Indian railroads, filled nearly all the positions of any responsibility.

Meeting Orders for Trains Running Under Reversed Rights.

An experienced train dispatcher on a Southern road sends a communication propounding the question, mentioned briefly at the last meeting of the American Society of Railroad Superintendents,* whether under the standard code a dispatcher may properly make a definite meeting point at an intermediate station for two trains whose rights have been reversed by an order under Form C, without first annulling the earlier order. The question presents a difficulty in the case of there being more than one section of either train moving under the operation of the first order, and it being not desirable to annul or supersede the whole order. The Society left the question undecided. Our correspondent sends an account of the proceedings of the regular monthly meeting of the Central Association of Railroad Officers held at Columbus, O., Aug. 27, at which meeting the question was taken up. In these proceedings the question and conclusion are stated as follows:

> The secretary reported the result of the correspondence with the superintendents of this association in regard to their views on the question submitted at the last meeting, relative to the right of a dispatcher to make a definite meeting point between trains designated in a right of track order [Form C] at an intermediate station, in case of a right of track order previously given to an inferior train against a superior train to a designated point, unless and until the previous order giving right of track to the inferior train is superseded or annulled, which was as follows: six superintendents replied that it would be competent for a train dispatcher to issue such an order, and eight that it would not. After discussion it was unanimously decided that, as there is nothing in the standard code of rules which could be construed as giving a train dispatcher any right to issue an order making a definite meeting point between trains designated in right of track order at an intermediate station under the conditions mentioned above, it would not be competent for a train dispatcher to issue such an order.

Our correspondent insists that this view interposes serious difficulty in the handling of trains, and is not warranted by the rules; and we think he is right.

There are two points involved in this question: First, what would be the safest way? and then, what do the rules authorize? Under the operation of an order of Form C the rights of the two trains are reversed, without any definite place being fixed for them to meet. Aside from any literal provision of the rules there does not seem to be any danger in giving a meeting order fixing a definite meeting place. The train "of superior right" is running as an inferior with respect to the other. Dispatchers are every day fixing meeting points by orders which practically annul part of the rights of superior trains without saying so, and the inferior, in such case, runs within the time of the superior without any other authority than the meeting order. Of course in issuing a meeting order in the case under consideration, due regard must be had to the existing superiority of either train in determining the succession in which the trains shall be addressed.

There really does not seem to be any necessity, in the case in question, to say, in connection with the meeting order, that the original rights are restored. In fact, annulling the order might very much interfere with the movement of other sections, and the attempt to annul or supersede a part of it would be unwise, as tending to complicate the order, even if the rules would admit of it. Neither safety nor compliance with the rules requires the annulling or superseding of the first order before giving the meeting order. As to what the rules allow, a paragraph, under Form L, forbids the superseding of an order in which has been included more than one specified movement, and it may therefore be said that the meeting order could not include a superseding clause for part of the Form C order, but must be preceded by an order annulling the whole of it if the meeting order is not permissible while the first order is in force. This is true in one sense, but not in another. The supposed order under Form C does not "include more than one specified movement." It simply reverses the rights of two trains. If either has more than one section, the result is that there is actually more than one "movement," if each separate meeting may be so considered in case the meetings are not all at one point, but it cannot be said that the order includes "more than one specified movement." If, however, we look to the reason for this rule, we see that the same considerations apply. If an order has been given including several movements (which is not, however, a good thing to do), and it is desired to change one of them, it would be difficult to frame a superseding clause that would be free from possible misunderstanding as to its effect on other trains, and, to preserve the desired simplicity and avoid complications, the rule properly provides that such an order shall not be set aside by superseding. To get rid of it it must be wholly annulled. In the case giving rise to this discussion, there does not seem to be any necessity for getting rid of the original order, but rather the reverse, and therefore we can but differ with the conclusion reached by the Columbus meeting.

Let us take a further illustration. Suppose that instead of the original order having been in Form C, it had been in Form D., which is the same in principle and might have been a separate example under Form C, with a slight change in the general title. Now it could not be imagined that under this state of affairs the original order should be annulled or superseded every time a meeting order is given. No. 1 simply runs as an inferior train and is helped by meeting orders when necessary. To annul the original order would lay up all trains "of inferior right" that happened to be in the time of No. 1. The principle in both cases is the same and the same practice should be followed.

* *Railroad Gazette*, Oct. 16, page 720.

The Mexican Railway.

Somewhat more than 10 years ago the *Railroad Gazette* published at some length a study of the growth of traffic and earnings of the Mexican Railway (Vera Cruz to Mexico, with branch to Puebla). This showed an extraordinarily light freight movement, and one which grew slowly. At that time this was the only railroad in Mexico, and it carried by far the larger part of its exports and imports; for there is not in Mexico, as in this country, a large population on the seaboard, and the large towns and well-peopled districts are and were on the table lands of the interior, around and beyond the City of Mexico. After years of struggles, the company had finally succeeded in completing its line; but its prospects seemed so poor that as late 1879 its ordinary shares sold as low as 6½ per cent. of their face on the London Stock Exchange. Then came the period of the construction of the American lines in Mexico, which, while adding immensely to the traffic and profits of the old road

during the time of construction, threatened eventually either to divert the very profitable import traffic from the Mexican Railway, or to make it unprofitable by compelling a great reduction of the rates, which in 1879 averaged on imports no less than 22 cents per ton per mile. It will be interesting at this time to see just how the business of the old English company has been affected by the working of the American lines and the other changes in the condition of Mexican affairs. It should be premised, however, that *direct* competition with the Mexican Railway has only just begun. Mexico has no export traffic worth mentioning, and the American lines which compete with the old road from Vera Cruz to Mexico do so by lines many times as long as the latter. Only within the last few months have the new lines between Vera Cruz and Mexico (Mexican Interoceanic) and the Tampico line of the Mexican Central been open for traffic.

When we examined the position of the Mexican Railway in 1881 we found that its entire shipments for export in 1879, were only 11,095 tons, and the total shipments of the City of Mexico, which had about 250,000 inhabitants, were but 9,908 tons—shipments no larger than those of many insignificant towns in this country. The greater part of the earnings of the railroad were from imports, and these, for the chief approach of a country of 9,000,000 inhabitants, were also small, equivalent to a daily movement of less than 50 tons. That the company had any net earnings was due to enormous freight rates. These in 1879 averaged 14 53 cents per ton per mile for all freight, and, as we have said, 22 cents for imported goods. The work on the new railroads, which began from the City of Mexico, was already stimulating traffic, however, and the gross and net earnings of the Mexican Railway had been for five years in silver:

	1875.	1876.	1877.	1878.	1879.
Gross	$2,370,605	$2,178,147	$2,700,907	$2,894,252	$3,257,235
Net	987,495	829,682	1,164,997	1,420,062	1,794,416

The carriage of materials for the new railroads proved to be a mine of wealth to the Mexican Railway, and the shares which in 1879 sold for 6⅛, received a dividend of 7 per cent. from the profits of *one-half* of 1882. The other traffic grew, but by far the larger part of the gain was from imports. Thus the movement of passengers and freight and of *foreign* freight was:

	1879.	1880.	1881.	1882.	1883.	1884.
Millions of passenger miles	15.5	16.0	17.0	20.0	20.1	18.6
Ton miles, total	18.1	21.3	31.2	40.3	38.9	24.4
Foreign	5.8	7.3	16.7	....	22.7	9.6

The carriage of materials for the new railroads came to an end practically in 1883, and accordingly we see the freight traffic, which had more than doubled since 1879, fall off 35 per cent. from 1883 to 1884, and of the total decrease of fourteen and half million ton miles, no less than thirteen millions was in imports.

The new railroads having been built, and having made the City of Mexico a railroad centre instead of a railroad terminus—a place where it was at least possible to collect products for export and to distribute imports through the interior—what was the effect on traffic? Beginning with 1883, we give the ton mileage of imports, of domestic freights, and of exports, as follows :

Millions of ton miles.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Imports	25.0	10.6	9.3	8.7	11.6	14.9	18.9	23.1
Domestic	10.9	10.4	9.2	11.5	12.1	11.0	14.5	13.2
Exports	1.5	1.1	1.8	2.8	3.1	3.5	2.9	2.7
Total	38.9	24.4	23.7	27.1	33.0	35.4	41 4	44.2
Passenger miles	20.1	18.6	17.8	17.0	18.3	19.0	20.9	22.0

Thus the great decrease in import traffic from 1883 to 1884 continued, and though this business began to grow again after 1886, not even in 1890 was it as large as in 1883. Nor has there been any considerable increase in the domestic traffic (which has been affected especially by the competition of a rival for the pulque traffic), for not till 1889 was it as large as in 1882 and 1883, and though larger in 1890 than ever before, it was but 10 per cent. larger than in 1882.

There remains the export traffic which we found so insignificant in 1879. It has increased more than one-half, but it remains insignificant, for there were but 17,100 tons in 1890, or less than 20 tons per day. The shipments of the City of Mexico increased about four-fifths since 1879, but they were still only 21,286 tons.

The passenger traffic, it will be seen, has not fluctuated greatly, but is now larger than ever before. We may add that in the first half of 1891 both passenger and freight traffic were larger than in any corresponding half year, the gain over 1890 being 16⅛ per cent. in passengers and 10¾ per cent. in freight. There was considerable railroad construction going on during the time, but how far the traffic of the Mexican Railway was affected by it does not appear.

It remains to see how the earnings of the railroad have been affected by these great fluctuations in traffic and by the competition of the new lines. We gave them above from 1875 to 1879. Since then they have been :

Year.	Gross.	Net.	Year.	Gross.	Net.
1880	$3,709,908	$2,147,588	1886	$3,221,035	$1,933,790
1881	4,935,100	3,131,388	1887	3,091,745	2,398,862
1882	6,011,280	3,795,053	1888	3,942,430	2,608,050
1883	5,712,271	3,102,490	1889	4,146,768	2,692,055
1884	3,756,718	2,250,992	1890	4,129,893	2,508,152
1885	3,323,110	1,950,685			

Thus the decline in earnings after the construction of the two great American lines was as marked as their growth before, the net being only about half as great in 1885 and 1886 as in 1882. Recently while the traffic has become as large as ever before, the earnings and especially the net earnings fall behind those of the three years from 1881 to 1883. Evidently the growth of new traffic has been had only by a reduction in rates such as was naturally to be expected when rates were so enormous as on this road before it had any competition. It should be added that as the Mexican currency is silver, and depreciation in that metal which was nearly 25 per cent. last year, was perhaps not more than half as great as in 1879, the figures given for earnings and rates of late years are really less favorable than they appear. This depreciation of silver is felt very decidedly by this company, for it must pay its interest dividends in sterling, and the discount on silver alone, on the net revenue remitted to the London proprietors in the first half of this year, was equivalent to 2¼ per cent. on the ordinary shares, which is just 2 per cent. more than they received.

The average rate per ton per mile, which we found to be 14.53 cents in 1879, was only 5.06 cents in the first half of this year: and the average on imports, 22 cents in 1879, is 8.09 cents. This seems to us a good round sum, but a reduction of 14 cents in 12 years is certainly very great. The average passenger rate never was extraordinarily high. It was 2.92 cents per mile this year against 3.15 in 1879. The road has three classes of passengers, and two-thirds of these passengers travel third-class, paying about 2¼ cents per mile. First-class passengers pay 5 cents.

As the average freight rate now is less than the cost used to be, and yet the railroad makes very respectable net earnings ($7,800 per mile in 1890), there must have been some saving in working expenses. The cost per train-mile is still heavy, amounting to $2.28 in the first half of this year. It was $3.06 in 1879. But the main saving has been by just doubling the average freight train load. This was but 57½ tons in 1879 and is now 115 tons. It must be remembered that this road has the longest very steep grade in the world, and it cannot make good the average by taking big loads down this grade, because there is very little freight to go down.

After all its growth, which, for a few years past, has been considerable and encouraging, the Mexican Railway has still a very light traffic. In the first half of this year it was equivalent only to 55 passengers and 98 tons of freight each way daily over the entire 321 miles worked. A train consisting of one of our passenger cars and five 20-ton freight cars could carry the whole of it. And that a road with such a traffic should earn net, as we have shown, $7,800 per mile seems remarkable, though the earnings are in silver. In gold they were equal to about $5,850 per mile.

During the three months ending with September the gross earnings were 14 per cent. less than in the corresponding period of last year, which perhaps reflects the influence of the recently opened competitors of the imports.

Australasian railroads are the subject of an article in the (London) *Railway News*, in the course of which it is said that there are now 9,679 miles of railroad in Australia, 1,948 miles in New Zealand, and 374 in Tasmania. This is distributed among 3,786,000 people and over 3,161,000 square miles. The mileage in each colony and the date of opening the first line in each are given as below.

Victoria	2,762	Sept. 14,	1854
New South Wales	2,182	Sept. 25,	1855
Queensland	2,112	July 31,	1865
South Australia	1,810	April 16,	1856
Western Australia	813		1873
New Zealand	1,948	Dec. 1,	1863
Tasmania	374	Feb. 19,	1871
Total	12,001		

Unfortunately for cheap transportation three different gauges have been adopted in Australia. In New South Wales 4 ft. 8½ in. is the standard, though one line in connection with a Victorian road conforms to the Victorian standard of 5 ft. 3 in. This is also the gauge of the greater part of the roads in South Australia, though there are over 700 miles of 3 ft. 6 in. roads in that colony; and this is the gauge of all the roads in Queensland, Western Australia, New Zealand and Tasmania. Australasian railroad systems have not been extended with great energy: in 1870 there was 948 miles, and in 1885, 8,045; and now only about one-seventh of the area is within 20 miles of a railroad. In other words, there is about one mile of railroad to 264 square miles of teritory. This is partly due to the fact that only on the coast of New South Wales and in the southern part of Queensland is any coal to be found, and most of the manufacturing is confined to Victoria, which has one mile of railroad to between 41 and 42 square miles, so that the most of the roads have to depend on agricultural produce, and wool does not give much traffic per acre. Another reason is that they depend, for both their money and material, on another country. The average cost per mile has been $49,965; the 4 ft. 8½ in. gauge of New South Wales costing $72,795; the 5 ft. 3 in. roads of Victoria, $64,755, and the 3 ft. 6 in. roads of Western Australia, $21,770. So that other considerations than width of gauge have governed costs. The average net revenue on all of the roads was, in 1888, 3.55 per cent. on their cost; this leaves a considerable deficit in the yearly budgets of most of the colonies, but this is readily borne for the sake of the development of the country.

Two complaints by the public against railroad practice were reported last week which are alike in that they both say what they do not mean, and unlike in that one is based on several claims which are just while the other probably deserves very little consideration on its merits (although, like the midnight visitor in the Scriptures it will have to be answered by the roads lest the complainant's importunity become wearisome). The National Transportation Association, composed of Boards of Trade and other commercial bodies of various cities, wants "a simpler form of bill of lading," and will apply to the Interstate Commerce Commission for an order compelling railroads to agree upon one; while the Boston Chamber of Commerce complains because freight rates from the west are five cents a hundred pounds higher to Boston than to New York. The first demand, which emanates from Chicago, is in reality not for greater simplicity but for fewer conditions. The bill of lading adopted by the railroads last year is really a simple one. It is very carefully drawn and its conditions are clearer and more sensible than any other document of the kind that we remember; but some of its conditions were drawn without sufficient consultation with representative shippers, and it would no doubt be a good thing for the Boards of Trade and the traffic managers to further discuss the matter. As long as it continues difficult for shippers to get prompt settlement of just claims against the railroads there is room for improvement in the shipping conditions. The Boston claim is simply for lower rates. It is hard to find wherein that city competes much with New York in selling goods that come from the West, and still harder to find any equitable justification for such competition where it does exist. The demand cannot refer to export business, for Boston already has as low rates as New York on that. Boston is entitled to as low rates as she can get; but her argument, this time, is rather top heavy.

Mr. Edison has at last allowed to be made public some thing of what he meant to say in the remarkable interview published in the New York *Herald* Oct. 25, concerning which we recently wrote. A member of the staff of the *Electrical Engineer* recently had with him an "exhaustive discussion" of the matter and the results appear in the issue of that journal of Nov. 18. It is said, in brief, that Mr. Villard requested Mr. Edison to devise a street railroad system applicable to the largest city, to avoid the use of the trolley or the conduit, stipulating simply that the system should not cost more than a cable road to instal. Mr. Edison has worked out a system, in which the current is conveyed from the central station, at high potential, to motor generators placed underground, close to the rails, which convert the current transmitted at the pressure of, say, 1,000 volts to one of 20 volts between rail and rail with a corresponding increase in volume. To use such a heavy current at low voltage it is necessary to be able to take up 1,000 ampères through two inches of mud, and this the new device can, it is said, readily do. A satisfactory joint between rails has also been devised, and an experimental track about one-fourth of a mile long is in actual operation near Mr. Edison's laboratory and "working to his complete satisfaction." This track has been short circuited with a carriage having iron wheels, with the result of getting only 200 ampères through the wheels. With an iron bar polished and weighted by a man standing on it 1,000 ampères passed through. The loss of current due to leakage between the rails under the worst conditions will be, it is said, not more than 5 H. P. per mile. The cost of this system is estimated to vary between $30,000 and $100,000 per mile of double track, not including the cost of the stations. The *Electrical Engineer* adds that estimates are now preparing for converting one of the largest street railroads in New York City to the electric system.

Cape Colony (Cape of Good Hope), which in 1873 had but 63 miles of railroad, made such progress in construction that at the end of 1884 it had 1,500 miles. Then construction practically ceased, only nine miles having been added during the next five years. The whole system of 1,608 miles is of 3 ft. 6 in. gauge, and has cost on the average $42,609 per mile. As a whole, it seems prosperous, the gross earnings in 1889 having been at the rate of $5,275 per mile of road, and $1.76 per train mile. As the

train loads must be small, this indicates high average rates. The working expenses were 53.2 per cent. of the gross earnings, leaving the very handsome net earnings of $2,453 per mile of road and 82 cents per train mile, which is 5¾ per cent. on the capital invested. The roads have an average train service of 4.11 trains each way daily. The number of passengers carried was 3,259,590 and the number of tons of freight only 593,510. Though Cape Colony is a new country, it does not export largely the coarse agricultural products which make the freight traffic of our railroads so heavy—no timber and little or no grains, but considerable wool. Its recent growth has been due chiefly to mining industries.

Newspaper dispatches announce that peat is being used with great success in Sweden for locomotive fuel. So far as we can ascertain the facts are as follows: For many years experiments have been made in Sweden with peat as a fuel for locomotives, but there has been no success, either mechanical or commercial, so far. Somewhat recently experiments have been made with a peat coke prepared in a new patent furnace. This coke has been tried for engine fuel on a small, narrow-gauge branch line and, according to the Swedish papers, with satisfactory results. Those who are in position to know the conditions, however, are not sanguine. The use of peat in competition with coal for ordinary fuel has not extended of late years in Sweden; and it is not thought probable that peat coke will be found a practical commercial competitor with coal coke for engine fuel unless an important duty is laid on the latter. There is no coal in Sweden suitable for coking and very little coal of any kind.

NEW PUBLICATIONS.

Modern Practice of the Electric Telegraph, by Frank L. Pope; 14th edition, re-written and enlarged. D. Van-Nostrand Company, New York. Price $1.50.

This book, notwithstanding the phraseology of the title, is practically a new work, the whole of the matter having been carefully re-written and considerable new matter added, a valuable feature being brief biographical notices of men who have distinguished themselves in electrical science. The work is primarily intended for young telegraph operators and is perfectly adapted to its purpose.

As many of our readers know from their acquaintance with the original work issued 20 years ago, it tells everything about the construction and operation of a telegraph line. At first sight a young operator may think that too much space has been given to the fundamental scientific facts connected with his art, and the author has, indeed made this department very full and complete for his readers; but no operator with any taste for reading whatever, can read a single chapter of Mr. Pope's fascinating descriptive matter without feeling a strong desire to study the whole book. Even if we admit that some of the matter concerning sources of electricity, theory of quantitative electrical measurement, the laws and conditions of electrical action, etc., is too technical for the average operator, it is still highly desirable that every superintendent or other officer having influence should advise every one of his employés in the telegraph service to read this book, for the mere reading is, in itself, a most valuable means of education for young persons who have had to leave school at an early age, which is often the case with telegraph operators and others connected with railroads. No better scheme of "University extension" could be imagined than to circulate such books as this. Mr. Pope has a lively, attractive and expressive style and at the same time writes with such thorough care that every paragraph and every line is characterized by the precise accuracy of a legal document. He states facts in strict and clear scientific terms while coincidentaly he presents his ideas in homely phrases, understood by everybody, so that the dullest "plug" who ever handled a Morse key can but receive great benefit from reading the work.

The temptation to include a class of material somewhat foreign to telegraphy has not been yielded to. Electric lighting and electric power are only touched upon, and even automatic, type printing, synchronous, submarine, and other more complicated telegraph apparatus are excluded. Notwithstanding the multitude of marvelous inventions, beginning with the House printer, that have been made during the past 40 years or so, and especially during the past 15 years, the old and familiar "Morse" still continues to be the principal means of communicating at a distance on land, and Mr. Pope rightly terms it "the ordinary system;" that is to say, it is too common to need a distinctive appelation. As a vital function of the telegraph is to make a *record* of the messages transmitted, and as this record, in all ordinary circumstances, can be made on a sheet of convenient size only by a process (penmanship) which is not much faster than Morse sending, the Morse system, with its great advantages in the matter of simplicity, seems destined to hold its ground for many years. The wages of good operators have dropped about 32 per cent. in the last 20 years, and the standard of ability demanded by both railroad and telegraph companies has perhaps dropped still a larger percentage, so that the old problem of finding and training operators has come to be of minor importance. This book, therefore, must continue to find a wide field.

TECHNICAL.

Manufacturing and Business.

The iron roof for the store house which the United States government is building at Willett's Point, L. I., will be furnished by the Berlin Iron Bridge Co., of East Berlin, Conn.

Watson & Stillman, of New York, have just placed on the market a larger sized hydraulic jack than heretofore built. The jack is specially designed for lifting heavy passenger cars, and is made with a broad steel base. It has a capacity of 30 tons, the height over all being 37 in. The jack lifts 22 in.

The Safety Car Heating & Lighting Co. reports that during the past few months sixteen railroads have adopted the Gibbs steam hose coupling, in place of the straight shoot couplings previously used. The Gibbs coupler is now used by 32 companies, operating 13,301 cars on 43,407 miles of road.

The Lee Composite Mfg. Co., of 29 Broadway, New York, reports that its "slagphae" paint for passenger car roofs is now used by the New York, Susquehanna & Western, New York, Ontario & Western, Delaware & Hudson, the South Carolina, Boston & Albany, Philadelphia & Reading, Staten Island Rapid Transit and New York, Providence & Boston. The paint is intended to prevent the cutting of tin on car roofs from the hot cinders from the locomotive.

Wm. Cramp & Sons' Ship & Engine Co., of Philadelphia, is making extensive changes in its plant on the Delaware River, and has placed the contract for a new boiler shop with the Berlin Iron Bridge Co., of East Berlin, Conn. This shop will be constructed entirely of iron, and will be composed of two parts, one part 55 ft. in width by 330 ft. in length, made very high between joints on account of moving large marine boilers over each other. This portion of the building is controlled by a 50-ton traveling crane, which is to be furnished by Wm. Sellers & Co., of Philadelphia. Connected with this main portion will be a wing 58 ft. wide by 370 ft. long, served the whole length by a 20-ton Sellers traveling crane.

The Atikokan Iron Deposits.

H. A. Wiley and W. W. Russell, C. E., of Port Arthur, Ont., were in Duluth last week on business in connection with the Atikokan iron mines in the range near Port Arthur. Mr. Wiley is confident that the mines will soon be opened up, and a branch built to Aikokan from the Canadian Pacific line. The question of smelters has not yet been brought into the present negotiations, but when the mines are developed it is likely that blast furnaces will be erected at some suitable place.

Shop and Station Notes.

The Boston & Albany has begun work on a new stone passenger station 60 × 25 ft. at Hinsdale, Mass.

The Grand Trunk locomotive shops at Stratford, Ont., are being enlarged by the addition of a new building, and their efficiency has lately been increased by the addition of $5,000 worth of new machinery.

At a meeting of the city council of Toronto last week a letter was read from President Van Horne, of the Canadian Pacific, saying that the company was doing all that it possibly could to advance the Union station agreement. No material points remained to be settled except as to the plan of the new Union station, about which he did not anticipate any difficulty.

The Louisville & Nashville will probably erect a repair shop and roundhouse at Montgomery, Ala.

The Alabama Midland has recently purchased for $35,000 the machine shops at Montgomery, belonging to the Louisville & Nashville, and is preparing to put them in operation.

J. J. Harper and others, at Monroe, La., are organizing a company for the purpose of establishing car shops and an iron foundry in Monroe.

Canadian Steamship Contracts and Projects.

The contract to build two twin screw steamers capable of steaming 18 knots, for the Richelieu & Ontario Navigation Co., has been awarded to Roche & Co., of New York. They will ply between Kingston and Montreal, and form a daily line independent of the regular boats.

The organization of a steamship company, to be managed by Halifax merchants and others, was started at Halifax, N. S., last week. Two steamers will be placed at once on the route between Halifax and Liverpool, or London, making regular trips every three weeks. The present owners of the ships, Messrs. McPherson, Brookfield and Barry, have subscribed $30,000 each. The two ships are put in at $145,000.

The pontoons on which the American yacht Wadena is to be floated to Montreal, are now in course of construction at the Ogdensburgh ship yard by Superintendent R. Wallace, of the Cleveland Shipbuilding Co. The yacht will be drawn out on the ways, and the pontoon fitted to her sides. It is thought from ten days to two weeks will be required to complete the work.

Pressed Steel Trucks.

The Fox Solid Pressed Steel Co., of Joliet, Ill., is meeting with gratifying success in the introduction of its pressed steel truck for freight and passenger cars. Orders have now been received from more than 30 different railroads, and one road has ordered a number for a new lot of cars to be built at its own shops. The works at Joliet have sent out about 100 trucks within a month, and the facilities for manufacture will soon reach a capacity of 100 per day. Special machinery has been ordered to punch the whole blank for the frame at one operation and to punch all of the holes in the frames and transoms at one stroke. This truck was illustrated in the *Railroad Gazette* March 27 last. It is entirely rivetted and weighs about 3,000 lbs. per car less than the ordinary type. It has about double the carrying capacity, and is several times more durable in rough service, as shown by the results from service on Mexican railroads.

Rebuilding the Wooden Trestle at Halifax Harbor.

The wooden trestle of the Intercolonial Railroad across the Halifax Narrows from Halifax to Dartmouth, N. S., which was carried away by the hurricane of Sept. 7 last, has been rebuilt for a distance of about 1,200 ft. The work was completed in about seven weeks, and the bridge is now considered to be much stronger and more substantial than the old bridge. The engineer in immediate charge was W. B. McKenzie, of the Intercolonial Railroad. T. C. Connor, a contractor of Moncton, N. B., was general foreman of the work.

This bridge is a wooden trestle, and was described in the *Railroad Gazette* of Oct. 2 last. About 800 ft. of the piling from the shore to the steel swing bridge was carried away by an unusually high wind and a heavy tide from the ocean. The trestle bents, which were placed 25 ft. apart and rested on ballasted timber cribs, were left standing, with one or two exceptions, anchored to their foundations.

Novel Type of Locomotive Boiler.

The Eastern Railroad of France is experimenting with a novel type of locomotive boiler, which is illustrated in the *Engineer* of Nov. 13. The boiler barrel is double, the lower part being filled with tubes and water. The steam is carried in the upper portion. The upper and lower circular shells are connected by three openings with flanged necks between.

Steam Heating.

The Philadelphia & Reading is having a number of its passenger engines fitted for steam heating, 15 locomotives having already been so fitted up. The hot water heaters and pipes that are at present in the cars will still be used. The work of changing the heating apparatus is being made at the company's shops in Reading. Steam heat is already in use on the Royal Blue line, and the company is now equipping the engines and cars that are in use on the Poughkeepsie Bridge route, and also those of the North Penn branch for the Buffalo connection with the Lehigh Valley Railroad.

THE SCRAP HEAP.

Notes.

Ten freight car thieves have been arrested by the Atchison, Topeka & Santa Fe in Chicago.

The bridge over the Tenton River on the line of the Great Falls & Canada Railroad has been burned.

The *Railway Service Gazette*, published at Toledo, has been sold to the *Railroader* and will hereafter appear monthly instead of weekly.

The Richmond & Danville now has in operation 19 miles of double track in the vicinity of Birmingham, Ala. Nine miles of this is operated under the block system.

In Central New York numerous petitions are being circulated asking the State Railroad Commissioners to investigate the question of Sunday work by railroad employés.

Some of the cars of the Minneapolis Street Railroad Co. are heated by electricity. There are four heaters in each car, costing $60. It is said that they give effective service.

A fast mail train is to run between New York and Chicago over the Pennsylvania lines, beginning Jan. 1. It will run through in 25¼ hours. It will leave New York at 9 A. M. and Chicago in the evening.

The Wheeling & Lake Erie yardmen at Toledo, who struck for higher pay on account of certain grievances, have returned to work. It is said that they secured the wages asked, but withdrew their other demands.

The 17th Annual Convention of the Railway Passenger and Freight Conductors' Mutual Benefit Association was held last week in Chicago. The attendance numbered 150. The organization has paid in losses since its formation $569,839.

Engineers have begun to survey the water power on the westerly outlet of the Lake of the Woods, Manitoba. It is understood that an immense dam will be built below the lower falls to concentrate the power from which water will be supplied to mills as required.

At Cincinnati last week a physician was arrested charged with having received a large number of stolen tickets of the Cleveland, Cincinnati, Chicago & St. Louis, and it is said that a number of train collectors on that road are implicated in the theft. One of the collectors has been arrested.

Last week one of the big Baldwin decapod engines for the St. Clair tunnel was run into the round house at Fort Gratiot, and placed upon the turntable. The immense weight of this engine broke the turntable in two. This accident will make it necessary to send the engines across to Point Edward to use the turntable there.

Proceedings have been commenced in the Circuit Court at Springfield, Ill., by the Wabash road to test the authority of the Board of Railroad and Warehouse Commissioners in permitting the Jacksonville, Louisville & St. Louis road to construct a piece of track across the Wabash at Litchfield to connect with the St. Louis & Chicago. The Wabash claims that the charter of the Jacksonville, Louisville & St. Louis did not contemplate the building of this connection, which it claims is something more than a side track, and for this reason the action of the board was illegal. The Jacksonville, Louisville & St. Louis and the St. Louis & Chicago both belong to the Jacksonville Southeastern system.

World's Fair Notes.

Contracts have been let for 450,000 sq. ft. of sidewalk and driveways at Jackson Park. The price paid is 6½ cents per square foot, or $29,250. The material to be used is medusaline, a concrete composition formed by treating sand with chemicals by a process known only to the manufacturers.

The foundations for the manufacturers' building are in, and one-third of the flooring laid. This building will cover 30½ acres, and is the largest of any building to be erected for the Fair.

Four thousand men are now employed on the World's Fair grounds.

Aluminum bronze roofs will be placed upon each of the five domes of the Administration Building. The contract for the work has been let to James A. Miller & Bro., of Chicago, for $54,000.

The statement of the Insurance Auxiliary Committee shows that at the present time a total of $651,698 insurance is being carried on the World's Fair buildings in Jackson Park. This will be increased as construction advances.

The Gamewell Fire Alarm Telegraph Co., of New York, has been awarded the contract for establishing a fire alarm telegraph system on the Exposition grounds for $5,000. The contract for the police telegraph alarm system will probably be granted to the Police Telegraph Co., of Chicago, for $4,000.

Canada's Fast Atlantic Service.

The following special cable from London has been received at Ottawa: "The last steamer under the Canadian mail contract has left Liverpool, and the negotiations here for the fast service are practically at a stand-

still since the death of Bryce Douglas, Manager of the Barrow Shipbuilding Co. The British Government has been approached by those already interested in Canadian trade, with a view to securing a service of ships somewhat better than the S. S. 'Parisian.' The Government, however, refused on the ground that the new service must be of Teutonic standard to meet the needs of the Imperial route to the east and to Australia. Every effort has been made to encourage capitalists here to take up such a service, the inducement being an annual subsidy of £165,000 for the service from England to Canada and Canada to Australia, £150,000 for the former and £15,000 for the latter. It is now admitted that all efforts have failed, and it is concluded that if Canada insists on such a high-class service she must make a further sacrifice."

The St. Louis River Water Power Dams.

The *Inland Ocean*, of West Superior, prints the following table showing the horse power that will be available when the water power of the St. Louis River is developed:

	Height, feet.	Head and fall, feet.	Horse power.* Minimum.	Horse power.* Average.
Dam No. 1	20	30	3,600	6,000
" 2	15	20	2,000	4,000
" 3	15	20	2,000	4,000
" 4	10	40	4,000	8,000
" 5	10	50	3,000	6,000
" 6	10	25	2,500	5,000
" 7	10	40	4,000	8,000
" 8	10	30	5,000	6,000
" 9	15	25	2,500	5,000
" 10	9	104	10,400	20,800
Total	124	364	39,400	72,800

*The columns marked "minimum" and "average" represent the power represented by the minimum and average winter flows as above determined.

Whatever value is assumed for a horse power of water the aggregate is large, and as each horse power averages employment for about one wage earner, it seems that there is a potentiality of a considerable manufacturing population in addition to those who are supported by commerce at the head of Lake Superior.

A Bear Story.

A rather laughable incident occurred at Garnett yesterday. Shortly after the southbound Santa Fe express, due here at one o'clock, left Richmond, a large cinnamon bear in charge of the Wells-Fargo Express Company and confined in a stout wooden crate managed to break out. He at once found himself "monarch of all he surveyed," Messenger Shook conceding him nine points in the law without a contest. Bruin, finding himself in peaceable possession, at once proceeded on an inspection tour. Detecting some apples in a lady's trunk, he at once demolished it, scattering silk dresses, perfume bottles, pictures "of my friend," etc., over the baggage car in beautiful confusion. He soon struck a richer find in the shape of a case of celery and a box of dried herring, both of which he managed to get outside of by the time the train reached Garnett. Here the conductor had the train side-tracked and determined to shoot him, but other counsel prevailed. A long pole with a sponge at the end saturated with chloroform was carefully introduced, and soon reduced him to a very peaceable state. He was soon placed back in his cage, and was again, after an hour and a half's delay, on the way to his destination.—*Topeka (Kan.) Capital.*

How to Deal with Train Robbers.

A correspondent of the New York *Times*, writing of the recent express car robberies near Milwaukee and near Utica, says: Generally speaking, an assault upon an express car would be defeated by a half hour's resistance. I would suggest something like the following:

1. Strengthen the express cars and provide loopholes through which an armed guard may shoot. Provide a turret in the fore part of the car where the armed guard may perch and protect the engineer and fireman, as well as the express car. One man always on duty would be sufficient.

2. Have the express safes built in the car so that removal would be difficult and protracted.

3. Have the keys of the safe, if a key is used to open it, kept at stations of the road only. Few robbers would slay the express messengers in cold blood if they were satisfied that the key of the safe was never in his possession. If safes were locked by a combination, the combination should be known only by some officer at the road stations.

4. Have all trains provided with means to telegraph for assistance.

5. So that, though the armed guard and messengers should be overpowered and access to the car obtained, the treasure might still be protected for a time. Provide in each express car suitable appliances to fill the car with steam, the guard and messengers escaping. . . . Even should this cost more than the amount stolen, the whole sentiment of the country, the interest of express companies and those of railroads, demand that express matter should be better protected and the express messengers relieved of the alternative of opening the safe or meeting death.

Cremation.

On October 23, John Hodgson, an ore filler, fell into the No. 2 furnace of the Carnforth Iron works. It is supposed that a barrow of ore had been brought to the top of the furnace by the hoist, that Hodgson had wheeled it to the furnace, and that he was in the act of emptying the ore into the mouth of the furnace, when the barrow overbalanced and he was precipitated into the furnace, where his body would be almost instantly consumed. The proprietors, with commendable feeling, at once requisitioned the services of a clergyman, who read the burial service over the fiery tomb.—*Iron.*

LOCOMOTIVE BUILDING.

The Kingston Locomotive Works have a contract to build ten engines for the Canadian Pacific Railroad.

The Chicago, Burlington & Quincy has placed with the Rogers Locomotive Works an order for 20 ten-wheel engines, all with 19 × 24 in. cylinders.

The Rogers Locomotive Works, Paterson, N. J., have ready for delivery to the Housatonic Railroad three eight-wheel passenger engines, with 19 × 24 in. cylinders, and a six wheel switching engine, with 18 × 24 in. cylinders, the balance of an order for seven, which included one other 10 wheel passenger and two other eight-wheel freight engines, already delivered.

The Philadelphia & Reading Railroad has placed with the Baldwin Locomotive Works an order for 21 new engines of the four cylinder compound type. One of them is of a special design and is intended for exceptionally fast speed. The engine will be a compound with Wooten boiler and firebox. The drivers will be 6 ft. 6 in. and the engine will have many new devices. It will have two high pressure cylinders of 13 in. diameter, and two low pressure cylinders of 22 in. diameter. The engine will weigh, when completed, between 108,000 and 120,000 lbs., and the tender will weigh about 65,000 lbs. It is to be completed by Jan. 1. Of the other 20 compounds, 10 will be of class I., each set of cylinders being 14 in. and 24 in. respectively in diameter. They are to be used in freight service on the Frackville Branch. The other 10 are also for freight service, and are known as class L. They will have cylinders 13 in. and 22 in. diameter respectively.

CAR BUILDING.

The Lehigh Valley will contract for 500 box cars in a few days, and will also shortly order 2,000 gondolas.

The Barney & Smith Mfg. Co., of Dayton, O., is building 30 very handsome passenger cars for the Queen & Crescent to run between Cincinnati and the South, and, as stated last week, the cars will be vestibuled and splendidly furnished. They will constitute 10 trains of three cars, exclusive of the sleepers. On five of the trains the cars will be lighted by the Pintsch gas system and five with the Frost light. The Barney & Smith Co. is building 16 new sleeping cars for the Canadian Pacific, and not 19, as stated last week.

BRIDGE BUILDING.

Covington, Ky.—The Cincinnati & Covington Rapid Transit Bridge Co. has been incorporated at Covington, Ky., by George Bullock, S. R. Benton, C. B. Smirall, of Cincinnati, and others, to construct a bridge across the Ohio River, connecting Manderson avenue in Covington and Race street in Cincinnati. The capital stock of this company is $5,000,000.

Nashwask, N. B.—The Dunbar bridge, near Nashwask village, which has been under construction for some months past, was completed last week. Messrs. R. A. Hanson & Sons were the contractors.

RAILROAD LAW—NOTES OF DECISIONS.

Carriage of Goods and Injuries to Property.

The Supreme Court of Illinois holds that a railroad which leaves loaded cars to be transported to a certain side track on its road, there to be unloaded by the consignee, the cars then to be transported by the company to its yard, is not liable for the cars as a common carrier when destroyed by fire while they are standing on the side track to be unloaded.[1]

In Texas the Supreme Court rules that a railroad is not liable for damages for failure to deliver goods to an unidentified consignee, where he fails to produce the bill of lading, though he may offer security.[2]

In Georgia it is held that Church property is private property, and is subject to condemnation according to law for railroad purposes, and in New York that lands under the waters of a navigable river, though owned by private individuals, may be condemned for the use of a railroad.[3]

The Pennsylvania Constitution provides that private property shall not be taken for public use without authority of law, and without just compensation being first "made or secured," and that corporations shall make just compensation for property taken, "which compensation shall be paid or secured" before such taking. A statute provides that the company must give a bond "with at least two sufficient sureties," and that, "if the bond and sureties are approved" by the court, the bond shall be filed in the court for the benefit of those interested. The Supreme Court holds that on approval by the court of a bond filed by a railroad company for the payment of damages, on seeking to take private property in the construction of its road, the right of the company to take the property became absolute, and it is immaterial that the bond was then or afterward became worthless.[4]

The Supreme Court of Pennsylvania decides that under the Constitution, which provides that "incorporations invested with the privilege of taking private property shall make compensation for property taken, injured or destroyed by the construction or enlargement of their works," a railroad company is not liable for injuries necessarily arising from the operation of its road after it has been constructed.[5]

In New York the Supreme Court rules that a railroad, in default of fencing its own land, lying along its track, from the track itself, is not liable to its own tenants for loss of cattle straying from such land onto its track.[6]

Injuries to Passengers, Employes and Strangers.

The Supreme Court of Minnesota rules that a railroad is not liable to a passenger for injuries received from an unexpected assault by another passenger, when the conductor interferes and separates the parties as promptly as possible.[7]

In New Jerey a passenger who was smoking entered the smoking compartment of a combination car, which was the rear car of the train, and finding every seat occupied, passed into the baggage compartment, at the rear of the car. There was a rule of the railroad company requiring those in charge not to permit passengers to ride in the baggage cars, but of this rule he had no knowledge. He and other passengers had frequently before been permitted to ride therein without objection, and the conductor had accepted and punched their tickets while in that compartment, as he did on the occasion in question. By the company's negligence a train, proceeding in the same direction on the same track, ran into the rear of the train on which the passenger rode, and he was thereby injured. The Supreme Court holds that, by taking his position in the baggage compartment, the passenger took the risk of any injury from dangers inherent in the construction or use thereof for the purpose of carrying baggage; but that his conduct, even if it contributed to an injury received from the collision, could not be deemed to have been negligent.[8]

In Mississippi the Supreme Court holds that where the conductor of a train returns to a passenger the wrong portion of a return trip ticket, and another conductor on the return trip refuses to accept it after the mistake is explained to him, and ejects the passenger from the train, the railroad company is liable.[9]

The Supreme Court of Texas decides that where a passenger concludes to go to a station beyond the one to which he has a ticket, he cannot demand that the train be stopped long enough for him to buy a ticket, and the company is justified in ejecting him on his refusal to pay the train fare.[10]

In an Alabama case the plaintiff knew of the company's rule requiring the use of sticks in coupling cars, and forbidding employés going between cars to couple by hand, and that the observance of this rule was one of the terms of his contract. Plaintiff having first failed to make the coupling with a stick, on account of defective drawheads, signaled the engineer to stop, and after the train stopped went between the cars. The engineer, knowing his position, moved the train before he could make the coupling. The Supreme Court rules that it was error to direct a verdict for defendant, since, notwithstanding plaintiff's negligence, the company was liable for a reckless or willful injury.[11]

In Texas an engineer was injured in a wreck caused by running over two cows. An inclosure had been fenced on each side, but no cattle guards had been put in, of which the engineer had no knowledge until he reached the inclosure. The law requires railroad companies to place cattle guards when its track enters any field or inclosure, which shall be so constructed as to protect such field or inclosure from the depredations of cattle. It also provides that, should any company neglect to put in proper cattle guards, it shall be liable to the party injured for all damages that may result. It is held by the Supreme Court that the statute was designed solely to protect the inclosures, and the failure to put in cattle guards was not evidence of negligence.[12]

In Kentucky an engineer was signaled by the conductor to go ahead so as to avoid collision with cars approaching them from the rear. To go ahead would have resulted in a collision with another train, which was crossing the track. The engineer, therefore, backed his engine, and it collided with the approaching cars, which, by their superior momentum, drove the engine against the other train, and killed the conductor. The Court of Appeals rules that the act of the engineer did not constitute willful negligence, nor render the company liable.[13]

In Minnesota the plaintiff was sent by a railroad company to repair a wrecked caboose on the line of its road. It was extremely cold, and a village 9 miles away was the nearest point at which he could get food and shelter. He was not provided with food or sufficient clothing for exposure to such weather. The company knew this, and that he relied on its sending for him in the evening. It did not do so, and he walked to the village. By the exposure he contracted rheumatism, and was permanently injured. The Supreme Court holds that he was not guilty of contributory negligence; that the company was negligent; and whether the injury was the proximate result was for the jury.[14]

In Utah, the Supreme Court holds that inspectors of railroad cars are not bound to apply physical force to the rounds of a ladder on a freight car, in order to test its condition, unless they see some indication of weakness.[15]

In Minnesota, the Supreme Court rules that where a car is transferred from one railroad to another, and it is out of repair when transferred, the company transferring the car is liable for the injuries sustained by a brakeman of the company receiving it in consequence of the defect in the car.[16]

In Iowa a railroad was in the habit of dividing its trains just before reaching a station, the forward section running on to a water tank, while the rear portion stopped at the station. Plaintiff, a section foreman, was making repairs at a switch near the station, and stepped off the track to let an approaching train pass, and then stepped back again, facing in the direction it had gone. The train was divided, and the rear portion, in charge of a brakeman, ran over plaintiff. Plaintiff knew of this custom, and that a cupola caboose and passenger coach were usually attached to the rear of freight trains. The Supreme Court rules that there was such contributory negligence on the part of plaintiff as to preclude his recovery.[17]

The Supreme Court of Tennessee rules that the statute providing that every railroad company shall keep the engineer, fireman or some other person upon the locomotive, always upon the lookout ahead, does not permit of the running a train with the engine in the rear, even with a lookout in front, so as to avoid the conditions of section 1299, that a company shall be liable for damages from failure to observe such precautions, and of section 1300, that proof of their observation shall be on the company.[18]

In Missouri the Supreme Court decides that a place in a railroad company's yard where the public have for a long time been accustomed to cross the track, solely by the sufferance of the company, is not a "public crossing," within the meaning of the statute relating to signals at crossings.[19]

In Utah, in an action for killing a child four or five years old, the evidence showed that the child wandered away from home and went to sleep on the track near a public crossing and schoolhouse, where children were frequently passing, and that the engineer saw an object there when about 200 or 300 yards away, but could not tell what it was until within 30 ft., when it was too late to stop. The Supreme Court rules that the failure to slacken so as to be able to stop if it became necessary was negligence; and that the child was not such a trespasser as to prevent recovery, even though plaintiff himself was negligent in permitting it to wander there unattended.[20]

[1] P. & P. U. R. Co. v. U. S. Rolling Stock Co., 27 N. E. Rep., 59.
[2] G., C. & S. F. R Co. v. Freeman, 16 S. W. Rep., 109.
[3] Mo. A. R. Co. v. Riggs, 13 S. E. Rep., 312; Kerr v. W. S. R. Co., 27 N. E. Rep., 833.
[4] Wallace v. New Castle Northern Ry. Co., 22 Atl. Rep., 95.
[5] Dooner v. Penn. R. Co., 21 Atl. Rep. ,755.
[6] Potter v. N. Y. C. & H. R. R. Co., 15 N. Y. S., 12.
[7] Mullan v. Wis. Cent. R. Co. (Minn.), 49 N. W. Rep., 249.
[8] N. Y., L. E. & W. R. Co. v. Ball, 21 Atl. Rep., 1,052.
[9] K. C. M. & B. R. Co. v. Riley, 9 South Rep., 443.
[10] Easton v. Waters, 16 S. W. Rep., 540.
[11] Hissong v. R. & D. R. Co., 8 South. Rep., 776.
[12] Ward v. Bonner, 15 S. W. Rep., 805.
[13] C. & O. Ry. Co. v. McMichael, 15 S. W. Rep., 878.
[14] Schumaker v. St. Paul & D. R. Co., 48 N. W. Rep., 550.
[15] Allen v. U. P. Ry. Co., 26 Pac. Rep., 297.
[16] Moon v. Nor. Pac. R. Co., 48 N. W. Rep., 679.
[17] Haden v. Sioux City & P. R. Co., 48 N. W. Rep., 733.
[18] Little Rock & M. R. Co. v. Wilson, 16 S. W. Rep., 613.
[19] Gurley v. M. Pac. Ry. Co., 16 S. W. Rep., 11.
[20] Hyde v. Union Pac. Ry. Co., 26 Pac. Rep., 979.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Concord & Montreal, $2 per share on "Class 2" stock (formerly Boston, Concord & Montreal new stock), payable Dec. 1.

Northern Pacific, quarterly, 1 per cent., payable Jan. 15

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama Great Southern, special, Birmingham, Ala., Dec. 15.
Atlantic & Danville, annual, Portsmouth, Va., Dec. 15.
Atlantic & Pacific, annual, 95 Milk street, Boston, Mass., Dec. 10.
Boston & Maine, annual, Lawrence, Mass., Dec. 9.
Charleston, Columbia & Augusta, annual, Columbia, S. C., Dec. 2.
Columbia & Greenville, annual, Columbia, S. C., Dec. 3.
Lehigh & Hudson River, annual, 80 Broadway, New York City, Dec. 7.
Georgia Pacific, annual, Birmingham, Ala., Nov. 25.
Keokuk & Western, annual, Keokuk, Ia., Dec. 3.
Memphis & Charleston, annual, Memphis, Tenn., and Huntsville, Ala., Nov. 30.
Richmond & Danville, annual, Richmond, Va., Dec. 2.
Richmond & West Point Terminal, annual, Richmond, Va., Dec. 18.
Rome, Watertown & Ogdensburg, annual, Grand Central Station, New York City, Dec. 28.
South & North Alabama, annual, Montgomery, Ala., Nov. 28.
Ulster & Delaware, annual, Roundout, N. Y., Dec. 8.
Utica & Black River, annual, Grand Central Station, New York City, Dec. 28.
Virginia Midland, annual, Alexandria, Va., Dec. 16.
Walkill Valley, annual, 5 Vanderbilt avenue, New York City, Dec. 9.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* will hold its next meeting at the United States Hotel, Beach street, Boston, Mass., Dec. 9. Commencing January, 1892, the regular meetings of the club will be held on the second Monday of each alternate month.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings at its rooms in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The *Southern Railway Club* holds regular meetings on the third Thursday of the months of January, February, March, May, September and November at such points as are selected at each meeting.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

Canadian Society of Civil Engineers.

The Canadian Society of Civil Engineers has sent out ballots for officers for the year 1892. For President the candidates are: Messrs. John Kennedy and E. P. Hannaford, of Montreal, vice Sir S. C. Gowski, retired; for Vice-Presidents (2), P. H. Peterson, Montreal, W. T. Jennings, Toronto, and Thomas Munro, Coteau Landing, Quebec; for Treasurer, Mr. W. H. Wallis, re-nominated; for Secretary, Prof. C. H. McLeod, nominated; for Librarian, Mr. W. McNab, vice Mr. Chadwick, resigned. There are 19 nominees for the 15 Councilors' places.

Engineering Association of the South.

A short report of the annual meeting held in Nashville, Tenn., Nov. 12, was published last week. Besides the regular report a communication was received from the general committee of engineering societies notifying the association that it had been assessed $200 to meet the expenses of the engineering headquarters during the World's Fair in Chicago.

The treasurer's report gave the total receipts during the year as $1,013, including a balance of $377 from the previous year. The balance now on hand is $403. The secretary's report gave the membership at the beginning of the year as 101, and at present as 108 members. There were six resignations during the year and two deaths. Ten of the 12 papers read before the association have been published. Seven meetings were held at Nashville and two at other towns.

The annual address of the President, John B. Atkinson, was a carefully prepared résumé of striking engineering features during the past year. The association will publish the address in full.

PERSONAL.

—Mr. George H. Vaillant, Second Vice-President of the New York, Lake Erie & Western, has been chosen Vice-President also of the Hocking Coal & Iron Co.

—Mr. J. S. Cushing, long connected with the Portland & Kennebec and Maine Central railroads, and for many years Treasuser of the latter, died at his home in Augusta, Me., Nov. 6, aged 83 years.

—Captain James W. Troup, Superintendent of the Puget Sound water lines of the Union Pacific, with headquarters at Portland, has resigned, and Capt. B. R. Pegrame has been appointed to fill the vacancy.

—Mr. Edgar Hill, formerly General Freight Agent of the Cleveland, Cincinnati, Chicago & St. Louis road, has accepted a position with the National Cordage Co., and will have charge of the shipping interests of the trust throughout the United States.

—Mr. M. L. Sargent, Traffic Manager of the Kansas City, Fort Scott & Memphis, who is at San Gabriel, Cal., for his health, is reported as growing worse and in a critical condition and he will be, as soon as possible, removed to his home in Kansas City.

—The name of Mr. William Thornburg, assistant to the President and General Manager of the Valley (Ohio) road, has been suggested for the office of State Railroad Commissioner of Ohio. Mr. Tnornburg says, however, that he has no desire for the office, and is not an applicant.

—Mr M. W. Carr, manager of the Government railways in Natal, South Africa, has been spending a few weeks in Canada, for the purpose of studying the railroad system of the Dominion and to examine and learn the methods of equipping and operating the lines to assist him in his official duties in Natal.

—Mr. Amos Root, who died at Jackson, Mich., last week at the age of 76 years, was a pioneer, and was identified with the building of every railroad entering that city. He was the President and organizer of the old Grand River Railroad, now operated by the Michigan Central. He had held many important political offices and leaves a large fortune.

—Mr. Powell Stackhouse, formerly First Vice-President of the Cambria Iron Co., has been elected to fill the vacancy caused by the death of President Edward Y. Townsend. Mr. Stackhouse has been connected with the company for a number of years. John W. Townsend has been elected First Vice-President, and John Lowber Welsh, Second Vice-President.

—Sir G. Czowski, one of the best known of the Canadian civil engineers, has declined renomination to the office of President of the Canadian Society of Civil Engineers, which he has filled with honor to himself and the society for several years. The two candidates elected by the nominating committee are Mr. E. P. Hannaford, Chief Engineer of the Grand Trunk at Toronto, and Mr. John Kennedy, Chief Engineer of the Montreal Harbor Commissioners. Mr. Hannaford is an Englishman and was born in Devonshire 57 years ago. He was an assistant for a number of years under the illustrious Sir I. K. Brunel. He became Assistant Engineer of the Grand Trunk in 1857 and Chief Engineer in 1869. The candidates for vice-presidents are also two prominent railroad engineers. Mr. P. Alexander Peterson is Chief Engineer of the Canadian Pacific, and Mr. W. T. Jennings, who is also a candidate, was Chief Engineer of the Ontario & Quebec Division of the Canadian Pacific until last fall and had charge of the construction of the extension to the Detroit River. He was elected City Engineer of Toronto, Ont., and held that office until recently.

ELECTIONS AND APPOINTMENTS.

Annapolis & Baltimore Short Line.—At the annual meeting recently held at Clifford's Station, Baltimore County, Md., the following Directors were re-elected for the ensuing year: J. S. Ricker, J. Hopkins Smith, W. C. Haskins, C. A. Coombs, W. W. Brown, Joseph B. Seth, F. E. Fennessey, John Glenn and Gerge Burnham. The directors re-elected the following officers: President, J. S. Ricker; Vice-President, J. H. Smith; Secretary and Treasurer, L. A. Burck, and General Manager, C. A. Coombs.

Aspen Short Line.—At the annual meeting held at Colorado Springs, Colo., last week, the following directors were chosen: Gordon Norrie, W. H. Reese, Jerome B. Wheeler, and John Sloan, New York, and H. T. Rogers, Denver.

Atchison, Topeka & Santa Fe.—The division from Atchison to St. Joseph has been attached to the eastern division, and the jurisdiction of Resident Engineer, J. M. Meade and Superintendent McLellan extended over the same, with headquarters in Topeka.

Baltimore & Ohio.—W. W. Picking has been appointed Passenger Agent of the road at Chicago, to succeed Henry V. Lucas, who has resigned.

Boston, Revere Beach & Lynn.—The annual meeting in Boston, Mass., Nov. 19, resulted in the election of the following as directors: J. S. Ricker, A. F. Breed, M. O. Adams, Matthew Bolles, M. S. Bolles, E. B. Stoddard and H. F. Hurlburt. The last two named succeed G. B. Upton and Jesse Tirrill, who declined renomination.

Brookfield & Northern.—The following are the directors of the company: W. J. Cox and J. D. Griffith, Mendora, Mo.; L. S. Bowden, J. R. Haffaker, B. J. C. Bettleheim, R. J. White, C. D. Bennett, H. Tovey, G. W. Martin, all of Brookfield, and W. W. Shearer, J. D. Brashear, Greencastle.

Canadian Pacific.—A number of changes and promotions are announced on the Toronto Division: R. R. Jamieson, Assistant Superintendent of the Owen Sound Branch, will assume a similar position at Smith's Falls, Ont., succeeding R. Cardiff. Mr. Jamieson's successor at Owen Sound is W. K. Thompson, Trainmaster at Toronto Junction. The Divisional Engineer for Toronto has not yet been appointed, but Messrs. E. G. Henderson and A. K. Kirkpatrick will fill those positions in London and Smith's Falls, respectively.

Chicago & Eastern Illinois.—W. H. Miller, Master Mechanic of the Columbus, Hocking Valley & Toledo, has resigned his position to accept the office of Superintendent of Motive Power and Machinery of the Chicago & Eastern road.

Chicago & Erie.—C. C. Reynolds has been appointed Assistant Superintendent of the Eastern division, with headquarters at Huntington, Ind. He has been trainmaster of the Erie at Buffalo for two years.

Dansville & Mount Morris.—Brooks P. Humphrey has been appointed Superintendent of this road. He is also Superintendent of the Tonawanda Valley & Cuba.

European & North American.—The annual meeting of the company was held in Bangor, Me., last week, and the following officers were elected: Directors, N. C. Ayer, F. Wilson, Sprague Adams, A. D. Manson, C. F. Bragg, C. F. Stetson, E. H. Blake, John Cassidy and C. M. Stewart; President, C. P. Stetson; Clerk and Treasurer, A. T. Thompson.

Illinois Central.—E. G. Russell, who has been acting as Division Superintendent for the Freeport division, has been transferred to Chicago to act as General Master of Transportation for the same road. F. W. Seymour, formerly Division Superintendent from Chicago to Cairo, succeeds him.

Kennebec Central.—The stockholders, at a meeting in Gardiner, Me., last week, chose Weston Lewis, President; P. H. Winslow, Treasurer; H. S. Webster, Clerk, and the following Board of Directors: Weston Lewis, David Dennis, H. W. Jewett, S. N. Maxey, A. C. Stillhen, J. S. Maxey, E. D. Haley, J. B. Dingley, Franklin Stevens.

Milbank, Egan & Sioux City.—The annual meeting was held at Milbank, S. Dak., and officers were elected as follows: William M. Brooke, President; J. H. Eno, First Vice-President; H. S. Volkmar, Second Vice-President; A. W. Diggs, Secretary; W. B. Saunders, Treasurer.

Mobile & Ohio.—Edward E. Posey, Chief Clerk in the passenger department of the company, has been appointed Acting General Passenger Agent vice Gordon W. King, resigned.

Moosilauke.—At the annual meeting held in Concord, N. H., the following directors were elected: J. H. Pearson, W. F. Daniell, Ira Whitcher, C. A. Busiel, H. N. Turner, A. B. Woodworth, E. B. Mann. The board organized with J. H. Pearson, President; S. B. Page, Clerk; E. B. Mann, Treasurer.

Newport News & Mississippi Valley Co.—Samuel W. Mullinix, Road Foreman of Engines of the Greenbrier and New River districts, has accepted the position of Master Mechanic of the Newport News & Mississippi Valley Co., western division, with headquarters at Paducah, Ky.

New York, Chicago & St. Louis.—W. J. Robertson has been made Car Accountant, vice J. M. Daly, resigned. Mr. Robertson was formerly Chief Clerk of the office and Mr. Daly, who has been Car Accountant for a long number of years, now resigns to become Superintendent of Car Service on an Eastern road.

New York, Lake Erie and Western.—At the annual meeting of the stockholders this week, the following directors were elected: John King, John G. McCullough, Ogden Mills, J. Lowber Welsh, William Wainright, William A Wheelock, Henry H. Cook, George W. Quintard, William Libbey, Cortlandt Parker, Morris K. Jesup, James J. Goodwin, William L. Strong, William L. Gilchrist, Josiah Belden, M. F. Reynolds and E. B. Thomas. The directors re-elected John King, President, E. B. Thomas, First Vice-President, George H. Vaillant, Second Vice-President, A. R. Macdonough, Secretary and Edward White, Treasurer.

New York & Northern.—The annual meeting of the stockholders was recently held, the following directors being re-elected: C. T. Barney, J. J. Belden, A. M. Billings, George Coppell, Thomas Denny, H. F. Dimock, R. M. Gallaway, G. G. Haven, R. S. Hayes, William Mertens, O. H. Payne, George W. Smith and William C. Whitney. The directors re-elected are R. S. Hayes, President; H. F. Dimock, Vice-President, and G. G. Haven, Jr., Secretary and Treasurer.

Ohio & Mississippi.—The adjourned meeting of the stockholders of the company was held in Cincinnati, Nov. 10, for the purpose of electing three directors. The result was favorable to the Baltimore & Ohio interest and the London stockholders. The stock held in trust by Brown, Shipley & Co., to be voted at the annual election, was voted by Franklin Aller for the three directors elected previously. They are Julius S. Walsh, St. Louis; D. Fannestock and Sterret McKine, of Baltimore. An objection to the trust vote was made, and may be the basis for future litigation.

Owensboro, Falls of Rough & Green River.—The following directors were elected at a recent meeting of the new stockholders to represent the interest which now controls the property: M. B. Mann, S. D. Turner, William Murphy, Belleville, Ill.; W. S. Wilson, Pinckneyville, Ill.; J. S. King, Metropolis, Ill.; M. V. Monarch, S. M. Deane, J. W. M. Field and R. S. Triplett, Owensboro, Ky. M. V. Monarch was elected President; M. B. Mann, Vice-President and General Manager; S. M. Deane, Secretary, and Lawson Reno, Treasurer.

Pennsylvania.—Charles W. Cross, Assistant Master Mechanic of the Fort Wayne shops of the Pennsylvania road, has been appointed Master Mechanic of the shops of the same company at Altoona, Pa.

Peoria & Pek'n Union.—C. E. Schaff has resigned his position as trainmaster of the Cleveland division of the "Big Four" system to accept the general superintendency of the Peoria & Pekin road. Mr. Schaff has been in the service of the "Big Four" for seven years in his present capacity.

Pittsburgh, Akron & Western.—C. W. Risley, formerly Superintendent of the road at Delphos, O., has been appointed General Superintendent of that road with headquarters at Akron, O.

Queen & Crescent.—Albert Lippincott, who has been Traveling Passenger Agent at Detroit, has been appointed Division Passenger Agent of the system at Chattanooga, to succeed D. J. Mullaney, resigned.

Sebasticook & Moosehead.—F. E. McIntosh, who has been Superintendent of the road for several years, has resigned on account of poor health, and D. E. Thompson is Acting Superintendent for the present.

Shepaug, Litchfield & Northern.—The stockholders' meeting was held in Bridgeport, Conn., Nov. 11. The following directors were elected: John L. Macaulay, William H. Starbuck, E. V. Carey, New York; F. H. Prince, Boston; William H. Stevenson, Bridgeport; Alexander McNeil, Phillip P. Hubbard and J. D. Perkins, of Litchfield, and Samuel E. Merwin, New Haven. John L. Macaulay was elected President and Col. William H. Stevenson was re-elected Vice-President. The other officers are E. V. Carey, Secretary; P. P. Hubbard, Treasurer and Alexander McNeil, General Superintendent.

South Carolina.—E. P. Waring has been appointed General Freight and Passenger Agent, to succeed the late S. B. Pickens. Mr. Waring was formerly General Claim Agent, and has been Acting Freight and Passenger Agent since Col. Pickens' death.

Utah Midland.—These directors were elected at the annual meeting in the Walker House, Salt Lake City, Utah, recently: W. S. McCornick and F. H. Auerbach, Salt Lake City; J. J. Hagerman, Irving Howbert, H. Colbran and C. E. Noble, Colorado Springs, Col., and H. T. Rogers, Denver, Col.

Wilmington & Weldon.—W. T. Walters, Michael Jenkins, H. B. Plant, B. F. Newcomer, J. P. McCay, A. J. De Rosset, D. MacRae, E. B. Borden, George Howard and W. H. Willard were re-elected directors at the annual meeting in Wilmington, N. C., Nov. 19. The following officers were elected: President, Warren Elliott; Vice-President, H. Walters; Secretary and Treasurer, Jas. F. Post, Jr.; General Manager, John R. Kenly; General Superintendent, John F. Divine; Traffic Manager, T. M. Emerson; General Auditor, W. A. Riach, and Engineer of Roadway, B. R. Dunn.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Atlantic Highlands, N. J.—The contract of Cofrode & Saylor, of Pottstown, Pa., on the new Sandy Hook line of the Central of New Jersey, is for a pile trestle and drawbridge near the mouth of the Shrewsbury River at Highland Beach. The drawbridge will be of iron about 270 ft. long, giving a 100-ft. channel on each side.

Attica & Freedom.—The Directors of this company, which is a reorganization of the Tonawanda Valley & Cuba road, have decided to abandon the seven miles of line between Fish Lake and Sandusky, N. Y., which have been heretofore operated, as well as the 27 miles to Cuba, which was abandoned a number of years ago although the track has never been taken up. This will leave 33 miles of road in operation between Attica and Fish Lake, N. Y. This line is now of narrow gauge, but it is intended to change it to standard gauge immediately.

Baltimore Belt Line.—The work on the Howard street tunnel in Baltimore for the belt railroad is being rapidly pushed by Ryan & McDonald, the contractors. The tunnel is completed and arched for 2,404 ft., about one third of its entire length. The headings have been pushed and the side walls erected for some distance beyond this completed work at each opening of the shaft. The masons are building the arch as fast as the headings are excavated. The completed work at each shaft is as follows: At German street, 726 ft.; Saratoga, 353 ft.; Franklin, 286 ft.; Madison, 328 ft.; Preston street and Park avenue, 711 ft. At Howard and Lexington streets the distance from the top of the arch to the surface of the street is but 14 ft., and to dispose of the water and drain pipes. Work on the open cut in South Howard street has been suspended pending the removal of the freight sheds of the Baltimore & Ohio Company. The open-cut work at the Bolton lot is going ahead, as is also the work in the third section, between Charles and St. Paul streets, at Seventh street. The work on the fourth section, near Bayview Junction, is suspended pending the settlement of some legal rights that are now before the Court of Appeals.

Baltimore & Ohio.—The company has let the contract for building the Morgantown extension of the road from Moore's works, just south of Uniontown, to Smithfield, Pa., and work has been commenced. Bennett & Talbott are the principal contractors, and this week or next they will have 500 men at work. The contract must be completed in three months. Two other firms have contracts on the extension. The line under construction is about 22 miles long. It is stated that officers of the railroad are looking into the feasability of a South Jersey extension of the road to Cape May, by the way of Salem, Bridgeton and Millville, and there is said to be a prospect of an early consummation of the project. The plan is to build a line from Pennsgrove, which is directly opposite Wilmington, and with which connection will be made by ferryboats.

Bangor & Aroostook.—During the summer and fall the engineers have energetically prosecuted the preliminary survey over the entire line between Brownville, near Bangor, and Presque Isle, Maine, and now that the winter weather will soon cause the field work to be brought to a close, the surveys have been run for nearly the entire 135 miles between the terminal points. The survey of the proposed road is now complete from Houlton, Maine, northward via Presque Isle to Caribou, and party No. 3 is at work from the latter named point toward the St. John River, in the town of Van Buren. The survey is also complete from Brownville, Maine, eastward to within ten miles of Houlton. Parties 1 and 2 are together there, and expect to complete the work to Houlton before the end of the month, after which one of the parties will survey a branch line from or near Easton, Maine, into Fort Fairfield, and the other will commence work upon the spur from or near Dyer Brook township northward to Masardis and Ashland. An exceptionally fine line has been found so far.

Bayfield Harbor & Great Western.—The right of way agents have completed the work of procuring the right of way through the Red Cliffe Indian reservation near Ashland, Wis., for this road. The company is also securing riparian rights on Lake Superior, and it is expected that the Northern Pacific will put in some elevators at the northern terminus.

Brookfield & Northern.—The Secretary of State of Missouri last week granted a charter to this company. The object of the organization is to construct a standard-gauge road from Miami, Saline County, Mo., to a point on the state line at or near Centreville, Ia. The line will cross the Missouri River near Dewitt, Carroll County, and pass trough the following counties: Carroll, Chariton, Linn and Sullivan. The length of the road will be 86 miles, and the capital stock is $850,000. The company has been incorporated in the interest of the Springfield, Sedalia, Marshall & Northern, and will be practically an extension of that line which has been surveyed between Springfield and Maine.

Canada Atlantic.—General Manager Chamberlain last week inspected the new branch line, running from Valleyfield, Ind., to Malone, N. Y. The line is about miles long, and will be opened for traffic immediately.

Canadian Pacific.—It is reported at Calgary that the survey party which left Calgary two weeks ago ostensibly to make a survey from MacLeod to the international boundary in connection with the Calgary & Edmonston road, has gone to the Crow's Nest. It is confidently believed in Alberta that the survey is made by direction of the Canadian Pacific, and is in connection with the proposed new line by the Crow's Nest Pass to the Pacific Coast.

Chicago, Burlington & Quincy.—The Burlington surveyors have just completed a new survey of the proposed extension of the Chicago, Burlington & Kansas City road from Bogard, Carroll County, to intersect the Hannibal & St. Joseph near Liberty, in Clay County, Mo.

Chicago & Northwestern.—A right of way has been granted the road to extend its track from the west end of its yard at Clinton, Ia., into the new manufacturers' addition. Work on the line will commence at once. It will be two miles long and is contracted to be completed in January.

Chicago & South Side Rapid Transit.—Track construction has been resumed on the Chicago Alley "L" road, and the line will probably soon be completed to its northern terminal at Congress street. The delay has been occasioned partly by trouble with the iron works in the East and partly by difficulty in obtaining right of way. Iron is again being received, and the right of way for the entire line has been secured. As soon as the the track is finished between Twelfth and Congress streets they will begin at the south end of the line and work north.

Choctaw Coal & Railway Co.—The United States Court for Oklahoma last week ordered the completion of the road to Oklahoma City at once. The necessary material to build the road is at El Reno, and Mr. Spencer, the contractor, has begun tracklaying. There will be 11 miles of track to lay, and, as the roadbed and bridges were completed months ago, probably trains will be running into Oklahoma City within three weeks.

Concord & Montreal.—The Concord (N. H.) Board of of Trade is agitating the subject of relaying the rails on the old Portsmouth Railroad, from Suncook to Candia, N. H., which were taken up in 1861 and not again replaced. An effort was made to repair the road last spring and to relay the rails, but an injunction was sued out by the Boston & Maine to stop the work, and the New Hampshire Supreme Court sustained it.

Crescent Connecting.—A charter for this company was issued in Pennsylvania this week. The road will extend from the Delaware River, near the Pennsylvania and Delaware state line, to Boothwyn Station, on the Baltimore & Philadelphia Railroad. The directors are Albert P. McDowell, J. Pemberton Ellis, Frank Manning, John I. Green, William Love, Joseph D. Ellis and Andrew Carson, all of Philadelphia.

Florida Southern.—A large number of men are now employed getting out crossties for changing the gauge of the road from Arcadia to Punta Gorda, Fla. It is stated that the work of changing the gauge will be completed by Dec. 15, and that through trains will be run into Punta Gorda by Jan. 1.

Grand Trunk.—A survey over the proposed route for connecting Midland with the Northern at Perkinsfield that is being made. The branch will be between four and five miles in length, and will shorten the distance between Midland and Toronto, by 17 miles. Tenders are invited for grading, masonry, track-laying and ballasting on that portion of the road between Vaudreuil and Brownsville, Ont., about 2½ miles.

Grayling, Twin Lakes & Northern.—With the force now at work on this road in Northern Michigan it is expected that the grading and tracklaying will be finished in about a month on the 27 miles of road between Grayling and Twin Lake, now being constructed. The contractor is William Crampton, of Bay City, Mich. It is the intention of the projectors to use the road at present entirely for logging purposes, but the company may in the future be incorporated for regular freight and passenger service.

International & Great Northern.—It is believed that the company will soon begin the reconstruction of the Columbia branch from Houston to Columbia, Tex. It is proposed to raise the roadbed three feet, put down new ties and rails. Proposals to do the work of raising the bed have been made to Burkett & Co., of Galveston.

Jacksonville, St. Augustine & Halifax River.—Two trestles on the new line through the town of San Mateo, Fla., one 100 ft. long and the other 50 ft. long, have delayed the tracklaying to some extent, but it is expected to have them finished so that the rails can be laid across them this week. The grading had been completed and one mile of track laid last week, this work being under contract to John Stewart. The new line is about four miles long from the junction on the main line where it leaves the old location.

New Roads.—J. C. Barlow, the engineer in charge of the surveyors running preliminary lines for the proposed railroad to connect the Monte Cristo mining district with the Seattle, Lake Shore & Eastern, says of new construction that his force of surveyors numbers about 50 men. One party is located at Granite Falls, Wash., near the Lake Shore Road, and the other one in the Monte Cristo district. They are working toward each other. It will take a month or six weeks to complete the surveys which are being run along the south fork of the Stillaguamish River, but both the eastern and the western termini of the road are indefinite. They will not be decided upon until the surveys are finished. The engineers will run lines along the north fork of the Stillaguamish. Leigh Hunt, of Seattle is one of the projectors.

There is some talk of a railroad from Leesburg, Va., to connect with the Baltimore & Ohio at the Point of Rocks, in Frederick County, Md. The distance is about 12 miles in a direct line. There is considerable travel between the two points. A long and expensive bridge across the Potomac would be required.

Col. Thomas E. Matson is surveying a new road from Cumberland Gap to Elizabethton, N. C. His first survey was from Johnson City to Elizabethton, and thence from Johnson City to Bean Station, and to the terminus at Cumberland Gap. This road will connect with the Bristol, Elizabethton & North Carolina at Elizabethton, and its object is to reach the ore fields of Carter County.

Norfolk & Western.—Messrs. Jones & Thorne, of Baltimore, have been awarded contracts for all the bridges on the West Virginia extension between Radford, Va., and Oda, about 50 miles. These contracts are for 26 bridges, across the East River and the creeks emptying into the New River, Va. The firm was also awarded contracts for grading said to amount to $200,000. The amount of all the contracts will be about half a million dollars.

Ohatchie Valley.—The engineers have recently resumed the surveying of this line, and this work is now in progress from Laney's toward Piedmont, Ala., connecting the Louisville & Nashville with the East Tennessee, Virginia & Georgia. A survey has also been commenced from Laney southwest toward Birmingham. Construction is at present suspended, but the prospects are good for the early completion of that portion between Laney and Piedmont.

Oxford & Coast Line.—The construction of the first section of this road from Oxford, N. C., to a connection with the Durham & Northern, a distance of four and one-half miles, will be commenced at once. The surveys have been completed, the grade being 1.8 per cent. The country is undulating, but the work will not be difficult. The grading will be carried on under the immediate supervision of the officers of the railroad. There is one trestle on the route about 600 ft. long. The greater part of the cost of building the line will be paid by the sale of bonds voted by the town of Oxford. W. F. Beasley, of Baltimore, is President.

Paducah, Tennessee & Alabama.—Tracklaying on the extension of the road from Paris to Hollow Rock, Tenn., which has been delayed by lack of rails and bad weather, was begun again at Paris last week. The extension is 26 miles long, and, weather permitting, and now that the rails have been delivered, the work will be finished in a month.

Pennsylvania.—It is announced positively that the construction work on the new Trenton branch will be completed by Jan. 1, and that passenger trains will commence running on the road about that time from Glen Loch to Morrisville, Pa. The work at Glen Loch, the western terminus on the main line, is about ready to be turned over to the construction department. Most of the stations have been located and a few small buildings erected, but the permanent station buildings are yet to be built. Thus far there is only one track between Glen Loch and Morrisville, with switches about two miles apart. It is the intention to double track the road its entire length. It is said that 35 daily freight trains will be put on the cut-off as soon as it is opened for travel its entire length. This will greatly relieve the traffic on tracks running through Philadelphia and facilitate the dispatch of through freight between New York and the West.

It is said contracts will be let at once and a large force put to work on the southwest extension between Fairchance and Smithfield, Pa., to parallel the new Baltimore & Ohio branch. The Pennsylvania will, it is said, build its road via the Georges Creek and New Geneva route and will be about 19 miles, reaching valuable coal and coke territory.

In the northern part of Indiana County, Pa., the company is extending a road to DuBois and Troutville, to secure control of the traffic of the eight-foot coal veins recently discovered in Brady township, the coal from which is now being shipped via the Buffalo, Rochester & Pittsburgh.

Philadelphia & Reading Terminal.—The work on the Reading Elevated road in Philadelphia is being pushed rapidly forward. All the buildings except that at the northeast corner of Ridge avenue and Noble street have been torn down. The line of the road is now plainly developed, and work at all points has begun. The most progress has been made at Twelfth and Arch streets. Here all the iron girders are in place, and the stone work is now ready. In a couple of days the iron supports for the floor of the new market house will be up. At Ninth and Wallace streets workmen are laying the foundation and support for a new turntable and roundhouse and a new coal shute. Between Spring Garden street and Hamilton the foundation stones and iron bars are in place. From Willow street to Carlton the stone piers for the tracks are built. From Callowhill street to Race the stone walls are erected, and two streets have been arched over.

Pittsburgh, Virginia & Atlanta.—A party of engineers has resumed the location of a road between Lexington and Glasgow, Va., which is to form a link of the proposed line from Pittsburgh, Pa., to the iron region of Virginia and North Georgia, projected by Gen. Fitz Hugh Lee, of Glasgow, and others, connecting the coal mines of Pennsylvania with the Virginia mines.

Port Angeles Southern.—The survey of the railroad has been completed to near Sequim, south of Port Angeles, Wash. The road will extend across Long Prairie, through Rena. The chief engineer reports the grades on the route, as far as surveyed, to be quite good.

Portland & Fairview.—The grading has been finished on about four of the 12 miles between Portland and Fairview, Or. The work is light, although the road is being built with a grade of 4.8 per cent. When the construction of the road was commenced it was the idea of the projectors to build a narrow gauge line to be operated by steam motors. This plan, however, has been practically abandoned, and the road will probably be operated as an electric line getting an entrance into Portland over one of the present electric street systems.

Savannah, Americus & Montgomery.—The surfacing and ballasting on the Montgomery extension between the Chattahoochee River and Montgomery is now going on, writes an officer, and the track is being put in

first-class condition. The officers hope to commence operating the line through to Montgomery early during the ensuing month, as the entire 90 miles of the extension has been completed. The steel drawbridge across the Chattahoochee River is practically finished and is a very substantial and probably the finest structure of the kind in the South. The roadbed is laid with 60 lb. rails the entire distance (Pennsylvania pattern) and has been constructed for an immediate heavy traffic. When the new road is put in operation it is believed there will be none better equipped in its section of country. Bridges, trestles, roadbed, water tanks, stations and warehouses are first class in every respect.

Starke & Sampson City.—Grading has been completed on the seven miles between Starke and Sampson City, Fla., the cross-ties have been laid and everything is ready for the track. The road has been built with a light grade, and a 50 ft. wooden trestle is the only bridge work. The road connects with the Florida Central & Peninsular, and will probably be operated as one of its branch lines. No equipment has been purchased by the incorporators, and no arrangement has been made to operate it as an independent road.

Sugar Run.—Three miles of this road between Sugar Run Station and Sugar Run Junction, Pa., have been completed, and five or six miles of the road will be completed and in operation this fall. The road is being built by the Allegany Lumber Co., of Olean, N. Y. It is about 12 miles long, connecting with the Allegheny & Kinzua at Sugar Run Junction, in McKean County, Pa., and with the Western New York & Pennsylvania in Warren County, Pa.

Westerly & Jewett City.—The adjournment of the Connecticut Legislature leaves the bill to charter this company no further advanced than last winter. The officers expect that the bill introduced in the lower house last winter will be passed when the assembly meets in January. The Rhode Island charter has been granted and over $50,000 of the capital stock subscribed. If the Connecticut charter is secured this winter the construction of the road will be commenced early in the spring. The proposed road is 28 miles long, between Westerly, R. I., and Jewett City, Ct., 12 miles being in Rhode Island. The road is to pass through the towns of Hopkinton, R. I., and Voluntown and Griswold, Conn.

Western Maryland.—The company will soon begin the construction of a new line from Five Forks, in Franklin County, Pa., to Hagerstown, Md. Since the compact for a connection at Harrisburg has been formed between the Reading, the Western Maryland and the Baltimore & Ohio, the freight and passenger traffic of the three roads has constantly increased. The new line will shorten the through connection about five miles, and avoid the heavy mountain grades.

Wilmington & Weldon.—On the branch being constructed between Fayetteville and Rowland, N. C., 17 miles of track has been laid, the work going on from both terminal points. Eight miles have been laid at the Fayetteville end and nine miles at the Rowland end. The track is now being laid by a force of about 100 men and will be fully completed Jan. 15. The stations have not yet been established except at Hope Mills and at Pembroke, where the line crosses the North Carolina Central Road.

GENERAL RAILROAD NEWS.

Canadian Pacific.—The arbitrators who have recently given their award in the claim of this company against the Dominion Government over the construction of the British Columbia section have still other points to consider. One has reference to the right of the Government to charge the company for certain rails which were laid into the ballast pits and on other temporary tracks on the Pembina branch, the company contending that it has the right to the rails free of charge as part of the branch. The amount of the Government claim is about $50,000. Another matter for decision has reference to the price to be paid for rails on the section between Port Arthur and Cross Lake, a claim for about $10,000.

Chicago, Rock Island & Pacific.—The company has sold $2,000,000 of five per cent. debenture bonds. The company received an offer for $1,000,000 more of the bonds, but declined to accept it, as the proceeds of the $2,000,000 sold place it in a position where no further money is required. It is understood that the bonds netted the company nearly 95.

Cleveland & Pittsburgh.—The special meeting of stockholders was held at Cleveland last week. The resolution passed by the directors on Sept. 23 last to issue $10,000,000 worth of bonds for the purpose of meeting indebtedness and raising funds for the improvement of the road as already described was discussed, and was formerly approved.

Concord & Montreal.—The directors have declared a dividend of $2 a share on the stock of Class 2, payable on Dec. 1. This was formerly Boston, Concord & Montreal new stock. It was created many years ago and this is the first dividend it has ever paid. The money to be used in paying the dividend came from a saving in refunding a portion of the debt of the Boston, Concord & Montreal corporation.

Lake Shore & Michigan Southern.—The report for the quarter ending Sept. 30 is as follows:

	1891.	1890.	Inc. or Dec.
Gross earnings	$5,880,397	$5,265,072	I. $615,325
Operating expenses	4,006,896	3,489,162	I. 517,734
Net earnings	$1,873,501	$1,775,910	I. $97,591
Other income	144,795	103,017	I. 41,778
Total income	$2,018,296	$1,878,927	I. $139,369
Charges	1,109,295	1,067,517	I. 41,778
Balance	$909,001	$811,410	I. $97,591
Cash	1,922,431	2,638,362	D. 715,931

Minneapolis & St. Louis.—New York stockholders of the company have started a movement to have that road taken out of the hands of a receiver. When the company defaulted on certain of its interest obligations in June, 1888, the President, W. H. Truesdale, was appointed Receiver. It is now stated that the road is earning sufficient money to pay all of its fixed charges. Some of the stockholders therefore insist that there is no longer any necessity for a receivership.

New York, Lake Erie & Western.—The board of directors of the company have declared a cash dividend of three per cent. on the preferred stock, payable on Jan. 15, in accordance with the recommendation of the Finance Committee. This is the first Erie dividend that has been declared since 1884.

The annual report for the fiscal year ending Sept. 30 shows the largest earnings in the history of the road. There was a slight falling off from last year in the earnings from general freight. The gross earnings of the system were $30,090,699, an increase of $1,021,764 over the preceding year, and the net earnings were $7,259,698, against $6,948,883. After the payment of fixed charges the surplus earnings amounted to $1,205,378, an increase of $145,124 over the year before and $2,382,321 over those of 1885. The sum of $256,098 is required for the payment of the declared dividend of three per cent. on the preferred stock, but after this deduction there remains a surplus which lacks only a few thousand dollars of being one per cent. on the common stock.

The earnings for the last three years are as follows:

	1891.	1890.	1889.
Gross earnings	$30,090,699	$29,068,935	$27,001,403
Due leased lines	2,587,066	2,614,101	2,109,130
Balance	$27,503,633	$26,454,834	$24,595,273
Oper. expenses	20,243,935	19,505,950	17,854,424
Net earnings	$7,259,697	$6,948,883	6,740,849
Other income	1,040,032	1,090,016	1,076,504
Total income	$8,299,730	$8,038,899	$7,817,353
All charges	7,291,352	7,178,645	7,042,576
Surplus	$1,005,378	$860,254	$774,777

Tonnage and passenger statistics are as follows:

	1891.	1890.	1889.
Tons merchandise	7,099,828	6,719,144	5,706,986
Rate per mile	.733	.753	.770
Coal, tons	10,751,675	9,587,982	9,376,146
Rate per mile	.540	.533	.566
Passengers carried	11,832,189	11,421,734	10,107,306
Rate per mile	1.545	1.584	1.639

Nova Scotia Central.—This road was sold at foreclosure at Halifax, N. S. Nov. 23 at the suit of the Farmers' Loan & Trust Co., of New York, trustees of the bonds, to James B. Eisenhauer and F. B. Wade, for $515,000. The road extends from Middleton, where it connects with the Windsor & Annapolis, to Lunenburg, on the Atlantic coast, a distance of 70 miles. It was built by Boston and New York capitalists at a cost of $1,500,000. The Dominion and Provincial Government subsidized the road to the extent of nearly $700,000.

Richmond, Fredericksburg & Potomac.—The annual report for the year ending June 30, last shows: Gross receipts, $756,649; operating expenses, $462,760; net earnings, $293,890; surplus, $52,084; expended in betterments, $19,548; balance, $32,536. Compared with the preceding year the gains are: Gross earnings, $47,035, or 6¾ per cent., net earnings, $24,520, or 9 per cent. The report states: The James River Branch was opened for business Feb. 2. All through freight is carried over it. The through passenger trains and two local trains continue to run through Richmond as heretofore. The James River Branch is operated on joint account with the Richmond & Petersburg Railroad.

Washington City & Point Lookout.—Active litigation is in progress over the Southern Maryland or Washington City Point Lookout road. The rolling stock has been carried off by a United States marshal and an attachment laid upon some of the right of way. The employés have also been unpaid for a long series of months.

Western Counties (Nova Scotia).—Judgment has just been delivered in London, Eng. in favor of this company and against a syndicate of English capitalists who repudiated an agreement made with the company to float certain debentures. The judgement now involves the necessity of carrying out this agreement, and is said to imply the deposit of $5,000,000 with the Dominion Government to pay of liabilities, including liens of bondholders and municipalities, and also to repay the federal authorities the amounts expended over the subsidies in building the "missing link" between Digby and Annapolis, 20 miles.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, Nov. 24, 1891.

Split tickets between Duluth and Detroit by way of Chicago are likely to raise a row in the Western Passenger Association unless the chairman is able to control the matter. The tickets in question are issued by a road running from Duluth to St. Paul, and are good over the Chicago, Burlington & Northern, Chicago, St. Paul & Kansas City, and Wisconsin Central to Chicago, and the Michigan Central Chicago to Detroit. They are sold at low rates and the time limit made sufficiently long to enable the scalpers to dispose of them easily. The Wabash has notified Chairman Finley that this manipulation is cutting into its Niagara Falls Short Line business and an open rate is threatened. Chairman Finley is now investigating and has asked the Wabash to suspend action pending the result of the investigation.

Another split ticket deal has been run down by agents of the Western Passenger Association, who have discovered that scalpers are handling a split ticket from Chicago to St. Paul, purporting to have been sold at Pittsburgh and issued by the Pittsburgh & Western, reading over the line of the Chicago, St. Paul & Kansas City. They are being sold at a scalp of $1.50, Chicago to St. Paul. When asked to redeem them, the Kansas City road deducted $1 as paid the Pittsburgh & Western as commission. If this is so, then the eastern line has been violating the agreement with the eastern lines. The Pittsburgh & Western claims that the tickets were sold in connection with its mileage tickets to Chicago to make up a through rate.

The Ohio & Mississippi yesterday withdrew the 21 cent rate on export flour, St. Louis to Baltimore, and advanced the rate to 26 cents per 100 lbs. Western Freight Association lines have made corresponding advances in the through rate via St. Louis.

No further progress has been made in the matter of divisions with the I. I. & I. road. It looks as though the Burlington and Alton had an understanding that each would defer action on the ground that the Atchison had not accepted and used the divisions. The Atchison put them in effect on Nov. 17, and about that time the Burlington announced the suspension until further notice of the new divisions which it had already put in effect, on the ground that the Atchison and Alton had not put them in effect. The Alton had already said that it would put them in effect as soon as the others did. Now the I. I. & I. road has brought suit against the Atchison and obtained a preliminary injunction restraining the latter from putting in the new divisions, on the ground that they are in violation of the contract between the two roads.

The Chicago & Grand Trunk has announced that it will absorb cartage charges in Chicago as follows: Lots aggregating 1 to 500 lbs., 25 cents per lot; lots aggregating 500 to 2,000 lbs., 3 cents per 100 lbs.; lots aggregating 20,000 lbs., 2 cents per 100 lbs. A meeting was held to-day to see what could be done to prevent the spread of this practice, inaugurated by the Grand Trunk, but nothing was accomplished, and the Grand Trunk seems likely to be able to advertise itself in this way for some time to come.

The Federal grand jury last week found indictments against the following named persons for having received rebates below the legal tariff rates: Gustavus F. Swift, Edwin C. Swift, Lewis E. Swift, D. Edwin Hartwell, composing the firm of Swift & Co., packers; and against George B. Spriggs, General Freight Agent of the "Nickel Plate," for having given the rebates. Bail was fixed at $2,500 each. It is stated that the parties who handled these rebates were Frank G. Bowles and Arthur Fay, employés of the Swifts, Bowles securing the rates and Fay depositing the same to his personal credit, from time to time transferring the account to the Swifts. At different times, it is said, he had to his credit sums approximating $30,000. It is presumed, from the list of officials of other lines subpœnaed, that the prosecution expected to prove that rebates had been granted by other roads than the Nickel Plate, but failed in their attempt to trace the rebates, as no indictments were returned except in the case of Spriggs. Sufficient information was secured from other quarters, so that it is understood the case against Fay and Bowles for refusing to testify will not be pressed.

Indictments were also found against John Firmenich and George Firmenich, composing the Firmenich Manufacturing Company, operating glue works at Marshalltown, Ia. The evidence on which the indictments were returned showed that they had been receiving rebates from the Chicago, St. Paul & Kansas City road said to have amounted to over one-half the tariff rate, in all some $80,000. The proof against the officials of the road was not sufficiently strong to fix the responsibility for the rebates, and therefore no indictments were returned against any of the employés of that company.

The investigation is to be resumed at Omaha next week. Chairman Midgley, of the Western Freight Association, and a number of other railroad officers have already been subpœnaed to appear there and give testimony. It is surmised that the investigation will take up the alleged discrimination practiced at Kansas City in stopping cars in transit billed through, for example, as salted meats, and reloading them with, say, tongues and cured meats, and sending them forward without changing the original billing. By this the rate is materially cut, both by increased loading and the substitution of freight taking a higher rate. As the rate from Omaha and Kanas City through to the East is the same there is a large loophole for manipulation.

The shortage of available cars for the movement of the immense grain crop from the West appears to be increasing rather than diminishing, notwithstanding the fact that most of the officers of the roads west of Chicago claim that they have cars enough to take care of everything that is offered. This statement is undoubtedly true, were they able to fully utilize their cars, but the trouble is that they are unable to handle the grain at the terminals and get the cars back promptly. The most pronounced complaint at present comes from South Dakota, and the railroad commissioners of that state have been in Chicago this week conferring about the accumulation of wheat in their state. C. E. McKinney, of the Board, says: "Our crop will amount to 60,000,000 bushels, and with not two-thirds of the crop threshed as yet, every elevator, granary, warehouse and car available is crowded and we need to-day from 3,000 to 5,000 cars." It is hard to see what improvement they can effect by coming to Chicago. The 10 grain carrying roads having terminals in Chicago were short last week approximately 7,000 cars. The Eastern roads are all short and the Michigan Central has given notice that it is unable to receive any more grain at present. With a working elevator capacity of about 20,000,000 bushels the Chicago elevators now have room for only about 8,000,000 bushels. Of the stock in elevators not more than a million bushels consists of corn and with favorable weather for the next three weeks the indications are that the elevators will be crowded to overflowing.

A prominent official stated on Monday that his information was to the effect that the Western roads were behind probably 10,000,000 bushels of grain, and that by Feb. 1, with favorable weather, they were likely to be behind 25,000,000 bushels. St. Louis and Minneapolis are not much better off, and it is safe to say, that allowing that all the lines work their equipment and motive power to its fullest capacity for the next five months, they will then be behind from 15,000,000 to 20,000,000 bushels.

Traffic Notes.

The East Tennessee, Virginia & Georgia has rejoined the Southern Passenger Association.

The railroads centring in Austin, Tex., have taken action looking toward the formation of a car service association. With the Texas law, making demurrage compulsory, the manager of this association ought to have a "soft snap."

Press dispatches from West Superior, Wis., last week stated that the rate on wheat to Buffalo by lake had gone up to 10 cents a bushel. Meanwhile the demand for vessels at the west end of the lake is so great that coal is taken from Buffalo to Duluth at 10 cents a ton.

The Superintendent of the Pecos Valley Railroad, in Texas, who has had to put partitions in his passenger cars to separate the races, says that the whole number of colored passengers carried during the year that the road has been opened is six, from which the receipts were $15.

The Houston & Texas Central has refused to transport about 40 carloads of lumber offered to it at Forth Worth by the Union Pacific. It is said that the refusal is based on an alleged unjust division of a through rate by the State Railroad Commission, and the Board is expected to issue a revised order, but meanwhile the lumber is detained.

It is said that Mr. D. H. Moffat, who lately retired from the presidency of the Denver & Rio Grande, has withdrawn from that company the large ore shipments controlled by him, giving the freight to the Union Pacific. The amount of freight paid to the Denver & Rio Grande on ore from the mines controlled by Mr. Moffat is said to have been $400,000 a year.

There is a great scarcity of soft coal in Minneapolis, caused by the wheat blockade on the line between there and Duluth. Hundreds of cars of coal are sidetracked at Duluth and Superior, the switch engines having more than they can do to keep the wheat cars moving. Chicago is taking all the Illinois coal, and this, with the fact of the strike among the miners in Indiana, cut the Minneapolis dealers off from all supply except Duluth.